DOCUMENT RESUME

ED 023 910 08 VT 007 245

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Effects of Field and Job Oriented Technical Retraining on Manpower Utilization of the Unemployed. Vocational-Industrial Education Research Report. Final Report.

Pennsylvania State Univ., University Park. Vocational Education Dept.
Spons Agency-Office of Education (DHEW), Washington, D.C. Bureau of Research.
Bureau No-BR-5-0085
Pub Date Aug 68
Contract-OEC-4-10-108
Note-119p.
EDRS Price MF-$0.50 HC-$6.05
Descriptors-*Adult Vocational Education, Comparative Analysis, Educational Programs, *Federal Programs, *Mechanical Design Technicians, Program Descriptions, *Program Evaluation, *Technical Education, Unemployed, Vocational Followup
Identifiers-*Manpower Development and Training Act Programs, MDTA Programs, Pennsylvania

A job-oriented program emphasizing application to the specific occupation of tool design was compared with a field-oriented program intended to give a broad basic preparation for a variety of jobs in the field of mechanical technology. Both programs were conducted under the Manpower Development and Training Act (MDTA) for a period of 52 weeks. Trainee selection was based upon eligibility under MDTA, high school graduation, familiarity with mechanics, desire to be technicians, and performance on the General Aptitude Test Battery. Based upon their personal preference, 35 trainees chose the job-oriented program and 40 the field-oriented program. Thirty trainees completed the job-oriented program and 25 completed the field-oriented program. During the first 2 years after the completion of training, 91 percent of the job-oriented and 63 percent of the field-oriented graduates were gainfully employed. Followup indicated no significant differences between groups as to. (1) their level of involvement with data, people, or things, (2) attitudes toward training received, (3) social class identification, (4) unemployment, and (5) employer rating. The field-oriented graduates earned higher average weekly salaries. It was recommended that shorter training periods be considered for the preparation of technicians in critical occupations and that training program flexibility be encouraged. (MM)

BR 5-0085
PA-08

VOCATIONAL EDUCATION DEPARTMENT OF THE PENNSYLVANIA STATE UNIVERSITY

FINAL REPORT

Project No. 5-0085
Contract No. 4-10-108

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VOCATIONAL - INDUSTRIAL EDUCATION Research Report

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

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THE PENNSYLVANIA STATE UNIVERSITY
UNIVERSITY PARK, PENNSYLVANIA

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ACKNOWLEDGMENTS

The conduct of this project has required the cooperation of more individuals and agencies than most similar undertakings. It is quite certain that persons, of whom I am not individually aware, have made contributions. It is therefore, with some hesitation, but with deep appreciation, that I attempt to acknowledge those who made this research possible.

The first work on the proposal for this research was by Dr. Carl J. Schaefer, then of the faculty of the Department of Vocational Education The Pennsylvania State University. His work was followed by that of Dr. Robert A. Campbell, of the same department, who prepared the research proposal and secured its approval. Before the project had begun, Dr. Campbell left Penn State and the present project director became responsible for the research.

Funding for this research was provided through the Office of Education. Each of the two training programs was separately funded under the provisions of the Manpower Development and Training Act.

One training contract was with the School District of the City of Allentown, and the other was with the Continuing Education Services at the Altoona Campus of The Pennsylvania State University. The close cooperation of these educational institutions and the administrators of these programs, Mr. George W. Elison who was Director of Vocational Education in Allentown, Mr. William A. Dunn, academic coordinator for the Altoona program, and Mr. Marcus K. Davis and Mr. Richard J. Lucas, District Administrators of Continuing Education for the Altoona program made the conduct of the research much easier. These men were ably backed by competent instructional staffs and advisory committees.

At the state level, the training programs were administered through Pennsylvania's Department of Public Instruction, Manpower Development and Retraining Division, and Bureau of Employment Security, Manpower and Training Programs. Mr. Paul Schalles, of the

Department of Public Instruction and Miss Catherine Elliott, of the Bureau of Employment Security provided encouragement and direction and assisted directly in the implementation of the research.

Reading of this report will suggest the continuing cooperative support which we have had from those who were students in these training programs and their employers. This cooperation was essential in our research activities and provided us with many satisfying professional and personal relationships.

The Steering Committee for this project has contributed ideas to the conduct of this research and has provided necessary reaction as the project has materialized.

Members of Penn State's Department of Vocational Education, Mr. Robert H. Binkley, Dr. George L. Brandon, and Dr. Joseph T. Impellitteri, participated directly in the conduct of this project.

As members of the team which periodically visited the training programs while in progress, Dr. George H. Parkes, Williamsport Area Community College and Mr. L. J. Sitterlee, Broome County Community Technical College provided many helpful observations.

Many of the ideas and much of the hard work in this research project can be credited to those who worked as Research Assistants. These persons were: Mr. Curtis Finch, Mrs. Brenda Kolker, Mr. Robert G. Schnelle, Mr. William R. Silkman, and Mr. S. R. Wiersteiner.

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Associate Professor of
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SUMMARY

The purpose of this research project was to compare two programs for the preparation of technicians in the field of mechanical technology. A job-oriented program emphasizing application to the specific occupation of tool design was compared with a field-oriented program intended to give a broad basic preparation for a variety of jobs in the field of mechanical technology. Both programs were conducted under the Manpower Development and Training Act.

Students for the two training programs were selected from throughout Pennsylvania. The State Employment Service was responsible for identifying, and initially screening each of the applicants. The research staff, with the cooperation of the training agencies and the employment service, developed the criteria for selection. These criteria included eligibility under MDTA, high school graduation or equivalency, some familiarity with mechanics and machine operation, and the expressed desire to be retrained as a technician. Tests selected from the General Aptitude Test Battery were used to measure intelligence, numerical, and spatial aptitudes. Final selection of trainees was completed by the research staff. Students were not assigned randomly to training programs, but were assigned on the basis of their personal preference for training location, 35 to the job-oriented program and 40 to the field-oriented program.

The two training groups were very similar in aptitudes, years of previous education and age. With a mean of 100 and standard deviation of 20, the GATB scores for intelligence (G), numerical (N), and spatial (S) aptitudes were near one standard deviation above the means on all three measures. Approximately one-third of the students in each program had completed some education beyond high school. About one-third were teenagers at the beginning of training. The oldest man in training was 47 and the youngest 18.

The job-oriented program was entitled Tool Design Technology. Facilities used were those of a vocational-technical school, with a program similar in many respects to the thirteenth and fourteenth years of a vocational-technical program. The curriculum for this training program was prepared with the advisement of an industrial committee in tool design. The field-oriented program was entitled Machine and Tool Design Technology. This program was offered on a two year campus of The Pennsylvania State University, and was prepared primarily by the engineering faculty of the University, with the advice of practicing professional engineers. Each program was approximately 52 weeks in length.

Approximately one-half of the course work in each training program was in drafting and design. Other course work was in mathematics, physics and applied physics, communications, manufacturing processes, and production problems. In the job-oriented program courses other than tool design were considered to be supportive of the tool design instruction. Courses in the field-oriented program were taught more as individual subjects.

There were three dropouts from the job-oriented program and two additional students designated as drafting rather than design students. Fifteen students dropped out from the field-oriented program. Twelve of these were dropped for academic failure.

From pretraining testing to posttesting job-oriented students showed significant gains in mathematics and mechanical comprehension. Field-oriented students made significant gains in mathematics and spatial relations. There were significant changes in the vocational interests and the social class identification of students during the period of training.

Several psychological and biographical variables were correlated with grade point average. In the job-oriented program two measures of spatial ability and a measure of mathematical ability were the best correlates. Measures of mathematical ability and mechanical comprehension correlated best in the field-oriented program.

Students generally expressed favorable attitudes toward the training they were receiving. Most students in both programs expressed their desire to work toward jobs related to their training, but more technical or with more responsibility.

Following training, data were gathered by means of interviews conducted six months, one year, and two years after the completion of training.

Although many graduates reported to work immediately after training, it required an average of almost four weeks for them to begin their first job. The time required by industry for the screening and selection of individuals they hired for technical positions was often two or more weeks.

Two years after the completion of training, 28 job-oriented design graduates and 17 field-oriented graduates were employed in industry. Two job-oriented and four field-oriented graduates were in military service. There were no data for three field-oriented graduates and one field-oriented graduate was unemployed.

During each interview a job analysis was conducted to determine the job skills and work field of the graduates. The analysis technique used was one structured by the United States Bureau of Employment Security and used in the preparation of the 1965 Edition of the Dictionary of Occupational Titles. A key focus of this type of analysis is the determination of the level at which the job requires the employee to deal with data, people, and things. In general, a hierarchy has been established in each of these three areas in which a lower code number identifies a higher level of involvement required by the job.

Two years after graduation 24 job-oriented and 15 field-oriented graduates were employed in the work fields of drafting and engineering. Others were employed in the work fields of researching (1), appraising (2), administering (1), and machining (2).

There were no significant differences between groups of graduates in the level of their involvement with data, people, and

things. There was some increase in the level of responsibility for graduates during the second year after completing training.

Of the industrially employed graduates, 93 percent of the job-oriented and all of the field-oriented were using some drafting skill. Three-fourths or more of the graduates of both programs were using freehand lettering, sketching, orthographic drawing, sectioning, dimensioning, and scale drawing skills.

One-half or more of the industrially employed job-oriented graduates were designing tools, layouts, and templates. The same was true of field-oriented graduates in designing fixtures, jigs, tools, layout, and gauges. Ninety percent of the job-oriented and 81 percent of the field-oriented graduates were doing some designing two years after graduation.

All industrially employed graduates of both programs were using some mathematics skills. Most frequently used were arithmetic, algebra, right triangle trigonometry, and plane geometry.

There were no significant differences between training groups in the satisfaction they derived from the supervision, promotion, work, pay, and people aspects of their jobs two years after graduation.

During the first year after graduation, 12 job-oriented and 13 field-oriented graduates, employed in industry, made geographic moves. During the second year, seven graduates of the two programs moved. Mobile graduates were significantly younger than immobile graduates. Mobile field-oriented graduates had significantly higher starting salaries than job-oriented graduates who moved. Immobile job-oriented graduates had significantly higher starting salaries than immobile field-oriented graduates.

Average weekly salaries for field-oriented graduates were higher than for job-oriented graduates at each of the three interviews. Two years after the completion of training, weekly salaries of graduates tended to be somewhat lower than those reported for Class B Draftsmen in metropolitan areas. Job-oriented graduates

earned $120.02 per week and field-oriented graduates earned $133.20 per week two years after graduation.

Graduates were rated on occupational technology, manipulative work, personal and social qualities, and work qualities and habits by their employers. Most graduates of both programs were rated above average or outstanding in all but occupational technology, where they tended to be rated average.

Graduates of each program reported the utility of training courses in the jobs they held. In both programs, courses in drafting, mechanics, and mathematics were rated as of much value. The machine shop and communications courses in the job-oriented program were also considered to have much value. In the field-oriented program other courses of much value were tool and die design, product design, and industrial processes. As perceived by graduates of the two programs, the value of all but five courses in the two programs increased during the second year on the job.

The social class identification scale which had been administered before and after training, was used again two years after graduation. Scores for graduates of both programs had decreased during the two years after training and were not significantly different from scores before training.

Significant gains were made by both training groups, as measured by standardized tests. However, it was concluded that the students of lesser ability achieved more in the job-oriented program than they did in the field-oriented program. Predictors of success in training were different for each program and should be developed by institutions offering technical programs.

Graduates of the programs were employable as technicians after a relatively short intensive period of training. Shortened training periods for the preparation of technicians should be considered in fields with high demand for workers.

Although the curricular content of the two training programs appeared very similar, there were differences in the execution of the programs. These differences seemed to result from the more

specifically defined occupational objective of the job-oriented program as opposed to the rather general occupational objective of the field-oriented program.

The job-oriented program produced more graduates, in part, because it was more flexible. Students whose training performance did not measure up in every respect, were allowed to continue in training. In spite of this flexible standard, the on-the-job performance level of the job-oriented graduates was comparible to that of the field-oriented graduates.

It was recommended that credit be given for training in similar programs. This would have been helpful to students, several of whom aspired to jobs which might require additional preparation.

The training situation in the job-oriented program bore greater similarily to the employment situation than did the field-oriented program. When the similarity of training and work are greater the transition to the job after training should be easier.

There were difficulties in the placement process of graduates of the training programs. Lines of communication between these technical programs and the employers of technicians did not appear to be well developed. Effort should be expended in seeking out prospective employers and informing them about the availability of graduates.

The follow-up procedures used in this study could be further refined to produce more specific information for curriculum and evaluation purposes. Job titles held by graduates would not have provided accurate indicators of job responsibilities. Follow-up data should be accurate and additional work on the methodology of gathering these data is needed.

CHAPTER I

INTRODUCTION

The preparation of technicians to fill the needs of a rapidly expanding technology in American industry has left many unresolved problems for the educator, the industrialist, and the manpower planner. The purpose of this study was to compare the process and the product of two curricular approaches to the preparation of technicians on the basis of observed behaviors of students during training and during the first two years of employment.

Behaviors were observed which would provide data to answer questions about what changes occurred in students during the period of training and what effect these changes had on these students after training. Employability, mobility, job satisfaction, job responsibility, and economic characteristics of program graduates were used to evaluate the effects of the two curriculums for the preparation of technicians on students with differing biographical, psychological, and social attributes.

The training programs in which students were prepared differed foremost in occupational objective and philosophy, although both programs were in the field of mechanical technology. A job-oriented program emphasizing application to the specific occupation of tool designer was compared with a field-oriented program intended to give a broad basic preparation for a variety of jobs in the field of mechanical technology. Both the job-oriented and the field-oriented philosophies and curriculums stemmed from differences in point of view from which the technician was observed.

The definition used by the National Society of Professional Engineers and the Engineer's Council for Professional Development (Friel, 1960) defined him as a broadly trained and engineering oriented member of industry:

> An engineering technician is one who can carry out in a reasonable manner either proved techniques which are common knowledge among those who are technically expert in this

> branch of engineering, or those specifically prescribed by professional engineers. Under general professional engineering direction, or following established engineering techniques, he shall be capable of carrying out duties which may comprise: working on design and development of engineering equipment or structures; estimating inspection and testing engineering equipment; use of surveying instruments; maintaining engineering machinery or engineering services and locating faults; connected with research and development, sales engineering and representation, servicing, and testing of materials and components, advising consumers and training and education.
>
> In carrying out many of these duties, the competent supervision of the work of skilled craftsmen will be necessary. The techniques employed demand acquired experience and knowledge of a particular branch of engineering combined with the ability to work out the details of a job in the light of a well-established practice.
>
> An engineering technician, therefore, requires a background sufficient to enable him to understand the reasons and purposes of the operations for which he is responsible (p.29).

The National Association of Manufacturers (1957) delineated the technician in a more specific job-oriented role:

> The technician holds a key between the engineer and the craftsman in industry, between theory and production. He uses drawing instruments, gauges, applied science, mathematics, diagnosis and analysis, common sense, initiative and good judgment in turning the ideas and theories of the engineer into mass-producted items. He collects data, makes computations, performs laboratory tests, and turns in reports. He builds, supervises, and controls the machines in our plants and offices. He is a key man at atomic installations, in aircraft and automobile factories, and also serves as a troubleshooter in electronics laboratories.

As differences in the definition of a technician existed, so did differences in how he should be prepared. Should the technician's preparation be specific to the job he will perform, or should it consist of basic technical elements applicable to several technical jobs? Logically, it appeared that the technician prepared in a job-oriented program would have the advantage of rather direct application of his training to work. The technician prepared in a field-oriented program would have to make more inferences to apply what he had learned, but would have the advantage of applying his preparation in a broader field of occupations.

In addition to questions about the way in which technicians should be prepared, this project was also concerned with the refitting of unemployed and underemployed workers for new employment. The job-oriented and field-oriented training programs were operated under the Manpower Development and Training Act, which at that time, allowed for up to 12 months of training. A prime concern of this project was the determination of whether unemployed and underemployed persons could be prepared as technicians within a limited period of time. Problems of motivation, adjustment to training, employability, mobility, and job satisfaction were seen as part of the problem of retraining workers.

Using selected student behaviors as criteria, two basic kinds of evaluations were made. 1) The outputs of the job-oriented and field-oriented training were compared and 2) the performance of students with varying biographical, psychological, and social characteristics were compared. These comparisons were made during the period of training, at the point of initial placement following training, and during the first two years following training. The training programs themselves were examined to more clearly identify the variables in training having a potential effect on students.

Specific Questions

In seeking solutions to the general problems posed above, specific questions were asked about 12 variables.

1. Student training achievement
   a. Was there any difference in the training achievement of students in the job-oriented and field-oriented programs?
   b. Was there a difference in training achievement related to personal characteristics of the students?

2. Vocational interests
   Was there any difference in the effect the two training programs had on vocational interests?

3. Social class identification
   Did the training programs differentially effect the social class identification of the students?

4. Attitudes toward training
   Did students in the two programs have differing attitudes toward the training they received?

5. Job responsibilities
   Was there a difference in the job responsibilities of graduates of the job-oriented and field-oriented training programs?

6. Job satisfaction
   Was there any difference in satisfaction with their jobs between job-oriented and field-oriented graduates?

7. Mobility
   a. Was there any difference in the mobility of graduates of the two programs?
   b. Was mobility related to the age or marital status of the graduates?

8. Unemployment
   a. Was there any difference in the rate of unemployment of graduates of the two programs?
   b. Was unemployment related to the mobility of the graduates?

9. Employer ratings
   Was there any difference between programs, in the ratings given graduates by their employers?

10. Salaries
    a. Was there any difference in the salary earned by graduates of the two programs?
    b. Were salaries related to the mobility of graduates?

11. Course ratings
    Was there any difference in the value of training as rated by employed graduates of the training programs?

12. Additional training
    Was there any difference in the enrollment in additional training after graduation between job-oriented and field-oriented graduates?

Multiple and single measures were used in determining the parameters of these variables. In some cases, a variable was measured with more than one instrument, while in others repeated measures were made.

Procedure

Students were selected from Pennsylvania through local offices of the Pennsylvania State Employment Service. A job-oriented program enrolled 35 students and was planned and operated by the Vocational Department of the School District of the City of Allentown.

Forty students were enrolled in a field-oriented program planned by the College of Engineering of The Pennsylvania State University and operated on a two year campus of the University. A selected battery of the General Aptitude Test Battery and a series of interviews were used to select students.

A series of examinations, to measure student capabilities in mathematics, verbalization, spatial relations and mechanical comprehension, was given before and after training. Using pretests as covariates, posttest comparisons were made between the two training groups. This same procedure was used with a vocational interest inventory and a social class identification scale.

During training, data were gathered about the attitudes of students toward training and the occupation for which they were preparing. A Chi square test of independence was used to compare responses of the two training groups.

Follow-up interviews were conducted with graduates of the job-oriented and field-oriented programs six months, one year, and two years after the completion of training. During each of these interviews a job analysis was conducted to determine the job responsibilities, job satisfaction, mobility, unemployment, and salaries of the graduates. On the second and third interviews employers rated the job competence of graduates. On the third interview graduates completed the same social class identification scale completed before and after training. Where appropriate, analysis of variance tests were used to compare training groups, within training groups over time, and students with differing personal characteristics. Graduates also evaluated the courses they had completed during training and reported on additional educational activities during each interview.

Application of Findings

With the reading of a research report, there are often questions about the interpretation and application of the findings. For this reason, some suggestions relative to this project are offered.

It should first be recognized that this was not experimental or quasi-experimental research. It may be more aptly described as demonstration with evaluation. It seems improbable that the total conditions and findings of this project could be replicated. Therefore the generalizability of the findings are limited. However, some of the conditions which existed in this project could be repeated. In such cases, it would be probable that findings similar to those reported here would recur.

The investigation of this project was with groups of students prepared under the Manpower Development and Training Act. Future retraining programs of a technical nature could utilize some of the findings of this project. In-as-much as educational conditions and students are similar, findings of this project could apply to community colleges, branch campuses, and technical institutes.

A difficulty with the interpretation of the findings of this study arises because of the small number of students involved. However, in cases throughout the report where statistically significant differences were reported, these differences were probably real and would be repeated with the same or a similar group of people 95 or 99 times out of 100. (Levels of significance were shown in tables.) Differences which were not statistically significant must be interpreted as probable chance happenings.

The size of the training groups made it infeasible to make comparisons of subgroups. Some interesting questions and relationships could not be pursued because reliable answers were not available from the data collected. Problems worthy of future study are suggested by many of these unanswered questions.

CHAPTER II

SELECTION OF STUDENTS

The purpose of this chapter is to describe the rationale and procedures used in the selection of students for the two training programs and the populations of students who were selected. More specifically the selection criteria and procedure, and the assignment of students to training programs are described. Data describing biographical and psychological characteristics of the training groups are presented.

Selection Criteria

The criteria for the selection of trainees were developed by the training agencies, the Pennsylvania Bureau of Employment Security, and the research staff. Little conclusive evidence existed to guide in establishing criteria for the selection of students for a program to prepare mechanical technicians, so considerable reliance had to be placed on the judgment of representatives of the educational institutions who had had experiences with similar programs. The accessibility of some specific types of data about the individuals considered for selection was also a determinant in establishing selection criteria.

All persons considered for training were first determined to be eligible for training under the provisions of the Manpower Development and Training Act. The criteria for selection were:

1. high school graduation or equivalency
2. satisfactory General, Numerical, and Spatial aptitudes as measured by the General Aptitude Test Battery
3. Some familiarity with mechanics and machine operation
4. an expressed desire to become retrained on a technical level.

Because a specific battery of the General Aptitude Test Battery had not been validated for the selection of mechanical technicians, it was considered best to use the battery validated for the selection of draftsmen. This alternative was chosen because approximately one-half of each of the training curriculums involved drafting.

Minimum scores validated for the selection of draftsmen were: G (intelligence) 115[1], N (numerical) 105, and S (spatial) 115. Test scores as well as data about the applicant's age, marital status, educational background, and work history were made available to the research staff from employment service records.

Selection Procedure

Each local office of the Pennsylvania State Employment Service was involved in the identification and selection of prospective students for the training programs. A preliminary announcement of the training programs was made to all local PSES offices. This was followed by a preliminary screening of applicants according to the selection criteria by those offices. On the basis of the numbers and locations of the eligible applicants identified, an itinery for final screening by the research staff was established.

Interviews by the research staff were held at twelve locations within the state. Applicants were interviewed at the location nearest their homes. Those who had to travel outside the district of their local office were paid a travel allowance for that travel. A total of 109 applicants were interviewed to fill 75 training positions.

Interviews were preceded by a group session in which questionnaires were completed by applicants and the training programs were described. The questionnaire was designed to verify data taken from employment service records and gather additional information about the applicant's background and aspirations. A motion picture entitled "Upgrade" (See Appendix A) was prepared to describe the job of the mechanical technician and the training program to prepare for it. This film was shown to all the applicants followed by a question and answer period. Applicant's indicated their preference for training program location.

Each applicant for the training program was interviewed by a member of the research staff. The purpose of the interview was to

[1]The mean score for all tests of the GATB was 100 with standard deviations of 20.

confirm the interest of the applicant in the training program and to give him the opportunity to ask questions. Based on the applicants fulfillment of the selection criteria, the research staff interviewer rated him as a potential student using a three point scale: 1) acceptable, 2) acceptable with reservation, and 3) poor risk.

After completion of all interviews, invitations were extended to selected applicants for training. Those applicants considered "acceptable" were first assigned to the program of their choice followed by assignment of those "acceptable with reservation" and "poor training risk." Thirty-five persons were assigned to the job-oriented program and 40 to the field-oriented program. Although there were some exceptions, students tended to select the training program located closest to their homes.

Because of the limited number of applicants for the training positions to be filled, not all selection criteria were adhered to strictly. In the job-oriented program, 18 of 35 students did not satisfy one or more of the stated selection criteria. Of 40 students in the field-oriented program, 25 were deficient in meeting one or more of the criteria of selection. The students were selected however, because their deficiencies were considered to be minor and perhaps within the range of error of the measure. Additionally it was believed that deficiencies of individuals were offset by other strengths.

Educational Status

All students enrolled in the two training programs had either graduated from high school or earned a high school equivalency certificate. Over one-half of the 75 students in both programs had completed some formal education beyond high school. Twenty students had completed an average of .63 and .50 years of education following high school in the job-oriented and field-oriented programs, respectively. In Table 2.01, numbers of students having completed education beyond high school are shown

Table 2.01

Numbers of Students Having Formal Education Beyond High School

	Training Program	
	Job-Oriented N=35[1]	Field-Oriented N=40
Type of School		
University or College	13	10
Military	6	5
Business or Industrial	0	1
Trade	4	4
Correspondence	1	4
MDTA	0	1
None	15	20

[1]Column totals do not equal Ns because some individuals had more than one type of educational experience after high school.

Aptitudes

As mentioned previously, General Aptitude Test Battery scores used were validated for the selection of draftsman. These aptitude scores were G (intelligence) 115, N (numerical) 105, and S (spatial) 115. Twelve job-oriented and 11 field-oriented students scores below the cut-off scores on one or two of the specific aptitude measures. Mean scores on the three aptitude measures for the two training groups were not statistically significant. Established means for all General Aptitude Test Battery tests were 100 with standard deviations of 20 based on a norm group typical of the general working population. In Table 2.02, mean aptitude scores, standard deviations, and ranges of scores for the job-oriented and field-oriented training groups are shown.

Table 2.02

Student Aptitude Scores for Training Groups

General Aptitude Test Battery Scores	Training Program: Job-Oriented N=35 Mean	Range	S.D.	Field-Oriented N=40 Mean	Range	S.D.
G (Intelligence)	121.5	104 147	10.01	123.0	105 151	10.19
N (Numerical)	116.8	95 132	10.68	117.5	91 138	11.78
S (Spatial)	125.8	97 153	7.12	127.1	84 163	13.23

Familiarity with Mechanics and Machine Operation

Based on Pennsylvania State Employment Service work histories, it was determined whether training applicants had had any mechanical work experience. Because of the relatively short length (52 weeks) of the training programs and the consequent lack of time to acquaint students with the characteristics and operation of manufacturing machinery, it was considered desirable to select students who had had these experiences. The work histories of 21 field-oriented and eight job-oriented students did not include such experience. Table 2.03 shows the numbers of students having or not having mechanical work experience. The difference between the two training groups was statistically significant at the .01 level.

Table 2.03

Number of Students with Mechanical Work Experience

	Training Program: Job-Oriented** N=35	Field-Oriented** N=39
Mechanical Work Experience		
Yes	27	18
No	8	21

** Chi square value for difference between groups significant at .01 level. level.

Desire to be Retrained as a Technician

The series of interviews which each training applicant completed was intended to inform him about mechanical technician training and employment opportunities and to form a basis for determining the desire of the applicant to become a mechanical technician. It was assumed that completion of the two or more interviews required in the selection procedure was an indication of desire to become a technician.

The contact with applicants made by the research project staff included the showing of the seventeen minute motion picture, "Upgrade," a group question and answer session, and an interview with each individual applicant. The motion picture film described the work performed by a mechanical technician and the program of instruction being offered. Question and answer sessions focused largely on employment opportunities and anticipated earnings for technicians, and allowances and instruction during training.

Following personal interviews, research staff interviewers rated each applicant acceptable, acceptable with reservation, or poor training risk. Interviewer ratings of students are shown in Table 2.04. Ratings were made prior to and without regard for assignment to training program.

TABLE 2.04

Interviewer Ratings of Students

	Training Program	
Interviewer Rating	Job-Oriented N=35	Field Oriented N=40
Acceptable	15	16
Acceptable, with reservation	18	23
Poor training risk	2	1

Descriptive Characteristics of Students

Although not used in selection, descriptive data about the age and marital status of students were gathered.

The mean age of the job-oriented students was 23.4 years. The oldest student was 42 years and the youngest 18. The largest age group was 18 years old. Seventeen entering students were married and 16 had children. The wives of nine married students were employed.

In the field-oriented group the mean student age at the beginning of training was 23.9 years. The oldest person to enter training was 47 years old and the youngest was 18. Eleven entering students students were 18 years old and had graduated from high school the previous spring. Nine of the students were married and seven had children. The wives of eight married students were employed.

Summary

Students for the two training programs were selected from throughout Pennsylvania. The Pennsylvania State Employment Service was responsible for identifying, and initially screening each of the applicants. The research staff, with the cooperation of the training agencies and the employment service, developed the criteria for selection. These criteria included high school graduation or equivalency, some familiarity with mechanics and machine operation, and the expressed desire to be retrained as a technician. Tests selected from the General Aptitude Test Battery were used to measure intelligence, numerical and spatial aptitudes. Final selection of trainees was completed by the research staff. Students were not assigned randomly to training programs, but were assigned on the basis of their personal preference for training location.

The two training groups were very similar in aptitudes, years of previous education, and age. With a mean of 100 and standard deviation of 20, the GATB scores for intelligence (G), numerical (N), and spatial (S) aptitudes were near one standard deviation above the

mean on all three measures. Approximately one-third of the students in each program had completed some education beyond high school. About one-third were teenagers at the beginning of training. The oldest man in training was 47 and the youngest 18.

CHAPTER III

THE TRAINING PROGRAMS

The objective of this research project was to compare the outcomes of two specifically designed curriculums for the preparation of mechanical technicians. A job-oriented curriculum emphasized application to the specific occupation of tool design. The other curriculum was field-oriented intended to give a broad basic preparation for a variety of jobs in mechanical technology. The concepts of job-oriented and field-oriented technical education have been described by Schaefer and McCord (1963).

> Engineering technicians, whose jobs have relatively wide scope and call for a high level of mathematical, scientific, and applied technical ability, are sometimes considered to be "semiprofessionals." They are usually oriented toward one of the major fields or branches of engineering (mechanical, electrical, chemical, aeronautical, construction, electronics, etc.). They need a broad postsecondary education with emphasis on applied technology, which will prepare them to assist engineers, scientists, or other professionals in their field They may generally be distinguished as being "field-oriented."
>
> The industrial technician operates within a narrower range of activities and is usually "job-oriented." His work centers on specific jobs: inspection, quality control, troubleshooting, and the like. He needs less mathematics and science than the engineering technician, and more limited training in technology. On the other hand, he usually needs more training and development in manipulative skills (p. 4).

It is here proposed that an examination of the two training programs will yield operational interpretations of job-oriented and field-oriented technical education, as it was conducted in these instances. It is not possible to separate educational philosophy from such things as administrative structure and facilities, however, these features of a program are not unrelated to its philosophy. Data and discussions concerning the curriculums and their development, the teaching faculties, the textbooks, and training costs are presented here.

Development of the Curriculums

In addition to the occupational objectives, generally described by Schaefer and McCord (1963), several other factors were considered by each of the training agencies in the preparation of their curriculums.

Because the training programs were operated with the support of funds from the Manpower Development and Training Act, certain specifications were drawn. The training programs were not to exceed 52 weeks in length. The length of the training week was to approximate the length of an industrial work week (40 hours). Programs were to operate within existing facilities, although the purchase of additional equipment to accommodate the additional students was allowable. Faculty members were to be hired according to existing institutional salary rates. Special consideration was to be given to the objectives of the Manpower Development and Training Act to retrain unemployed and underemployed workers for gainful employment.

Job-Oriented Program

The School District of the City of Allentown, Pennsylvania, was responsible for the planning and operation of the job-oriented program in tool design technology. Administrators of the vocational and adult education programs of the District, with the aid and advisement of a committee from local industries, developed the curriculum.

The program of instruction covered 50 weeks. This period of time was not divided into terms, but courses of varying lengths were scheduled to fill out each week of instruction. Approximately one-half of the instruction time was used for drafting and design instruction. This was scheduled in half-day periods from the beginning to the end of the program.

The facilities of the Allentown School District were used for all classes. In the case of the drafting and design classes, the available classroom could accommodate eighteen students. For this reason, the class of 35 was divided into two sections for the drafting and design instruction.

The scheduling of classes was also effected by the availability of teaching staff. In some areas of instruction, faculty members from the Allentown schools were used on a part-time basis. In some others, part-time instructors were taken from industry. In both cases, some classes had to be scheduled during the late afternoons and evenings to make utilization of these instructors possible. A student's schedule included drafting and design during either the morning or afternoon and instruction in the other subjects during the late afternoon and evenings.

It was intended that the various courses taught be related to each other and to the occupational preparation of a tool design technician. Much of the advisory committee's effort was spent in determining what knowledges were necessary for the performance of the job of a tool design technician. In turn, program administrators were concerned with developing an occupationally oriented, meaningful whole out of the several separate subject matters taught.

Within the philosophy of retraining of the job-oriented program, it was held that any student who showed the characteristics judged to make him employable as a tool designer or at a lower technological level would be retained in the program. Students failing mathematics or a related science course would not be dropped from the program provided they exhibited a desire to continue training and were making satisfactory progress in drafting and design courses. Such graduates would be recommended for employment appropriate with their educational accomplishments. (There were three dropouts and two designated as drafting trainees from among the 35 job-oriented students.)

Field-Oriented Program

The field-oriented program, planned and operated by the Department of Continuing Education in Engineering of The Pennsylvania State University was intended to prepare machine and tool designers. The core of this program was taken from the University's evening class diploma program in machine and tool design. Added to this were courses in physics, industrial organization and management, speech, human relations, and problems courses in technical areas.

The program of studies was organized by the faculty in Continuing Education in Engineering and submitted to an advisory committee for review. This advisory committee was composed primarily of engineers employed in industry who also served as part-time instructors in the University's evening program.

The program was divided into seven terms, each consisting of 32 days of instruction. The total elapsed time from the enrollment of students to graduation was 47 weeks. The terms were tightly fitted together with no lapse between terms. After the first term, continuation of studies for the student was dependent on his work the previous term. (Fifteen of 40 students were dropped from the field-oriented program.) Each term some of the courses offered required the satisfactory completion of prerequisite courses. Each course taught was considered to be an independent unit of instruction.

Since the field-oriented program was offered on a two year campus of The Pennsylvania State University with approximately 800 full-time students in baccalaureate and associate degree programs, the utilization of classroom facilities by those students was a determinant in scheduling classes. Additionally, the employment of some part-time instructors from industry made it desirable to schedule some courses in late afternoons and evenings. Most courses for the 40 field-oriented students were scheduled as a single section. For some courses, the class was divided into two sections because of the subject matter and the class space requirements.

Courses taught in the field-oriented program did not carry college credit. A diploma was awarded to each student who completed the program. For this reason it was deemed necessary by the program planners to adhere to academic standards comparable to those maintained in the evening class diploma program. Although the program was a retraining program with an objective of returning workers to the labor force with a new saleable skill, it would have been considered detrimental to the student and to the program to have altered the academic standards.

Facilities

The instructional facilities used for the two training programs were quite different from each other in appearance and setting. The job-oriented program used classrooms and laboratories of the School District of the City of Allentown, Pennsylvania. These facilities were primarily those used by the vocational and adult education program but included some high school classrooms. Drafting and design classes were conducted in a former commercial building which had been remodeled for post-high school programs. The machine shop, welding shop, and some academic classrooms were used in the high school while high school classes were not in session.

The field-oriented program was conducted on a two year campus of The Pennsylvania State University in Altoona. This campus included classrooms, faculty offices, library, cafeteria, student lounges, and dormitories, which, with the exception of the dormitories, were used by the field-oriented program.

The drafting and design facilities in the job-oriented program were developed to resemble the industrial employment situation while those in the field-oriented program had the appearance of engineering drafting classrooms. Drafting tables equipped with drafting machines were used in the job-oriented program. Drawing boards with T-squares and triangles were used in the field-oriented program. The job-oriented drafting room included a "working library" with technical handbooks, design references, trade journals, and vendor's catalogs. The field-oriented library was housed with the campus library on a special shelf and consisted primarily of books to supplement textbooks used in courses. Trade journals were available from the campus library collection.

In the job-oriented program there were definite attempts to relate the drafting facilities to the employment situation and to make the transition from education to employment easier. Facilities in the field-oriented program were viewed as locations for teaching and learning without any particular relationship to employment.

Programs of Instruction

Each training agency independently developed its program of instruction. Hours of instruction for a single subject in the job-oriented program varied from 15 to 581. In the field-oriented program courses were developed within the framework of multiples of 16 hour units taught over 32 instructional days in a term. Total hours of instruction in the job-oriented programs were 1637 and 1616 in the field-oriented program. In Tables 3.01 and 3.02, course titles grouped by areas of instruction, together with hours of instruction for each program are shown. A comparison of Tables 3.01 and 3.02 indicated some differences in hours of instruction between the job-oriented and field-oriented training programs. The most obvious differences between the two programs were in manufacturing processes, where the job-oriented program of studies included about three times as much course work as the field-oriented program, and in physics and applied physics, where the field-oriented program exceeded the job-oriented program by 91 hours.

The diversity of course titles was greater in more areas of instruction in the field-oriented program. This was true in drafting and design, mathematics, communications, and production problems. There were more different course titles in the job-oriented program in physics and applied physics and manufacturing processes.

Units of instruction included under some course titles indicated more breadth of subject matter in the field-oriented program than in the job-oriented program. For example, the job-oriented program did not include any product design, while the field-oriented program did. Physics and applied physics, as taught in the field-oriented program, was broader and included the study of more subject matter requiring the application of mathematics. Communications in the job-oriented program did not include speaking, as it did in the field-oriented program. Course units offered under production problems in the field-oriented program were aimed more toward understanding of management, including units such as working capital and investment, depreciation, and intangible analysis, than were units in the job-oriented

Table 3.01

Job-Oriented Program of Instruction

Area of Instruction	Hours of Instruction Theory	Practice	Course Total	Total
Drafting and Design:				
Basic Engineering Drawing	30	250	280	
Tool Design	70	511	581	
				861
Mathematics:				
Mathematics	165	---	165	
				165
Physics and Applied Physics:				
Strength of Materials	45	15	60	
Mechanics	57	18	75	
Hydraulics	12	3	15	
Pneumatics	12	3	15	
				165
Communications:				
Communications	45	---	45	
				45
Manufacturing Processes:				
Machine Shop	40	190	230	
Welding	6	10	16	
Metallurgy	22	8	30	
Manufacturing processes	30	15	30	
				321
Production Problems:				
Production Problems	15	15	30	
Quality Control	15	15	30	
				60
Field Trips	---	20	20	
				20
				1,637

Table 3.02

Field-Oriented Program of Instruction

Areas of Instruction	Hours of Instruction			
	Theory	Practice	Course Total	Total
Drafting and Design:				
Engineering Drafting	32	128	160	
Jig and Fixture Design	---	64	64	
Tool and Die Design	16	80	96	
Mold and Die Design	16	80	96	
Kinematics and Machine Design	32	208	240	
Product Design	---	192	192	848
Mathematics:				
Slide Rule	32	---	32	
Technical Calculations	---	128	128	
Algebra	32	---	32	
Trigonometry	32	---	32	224
Physics and Applied Physics:				
Elementary Physics	32	---	32	
Mechanics and Strength of Materials	96	128	224	256
Communications:				
Technical Writing	32	---	32	
Speech	32	---	32	64
Manufacturing Processes:				
Industrial Processes	64	32	96	96
Production Problems:				
Industrial Organization and Management	32	---	32	
Engineering Economics	32	32	64	
Human Relations in Management	32	---	32	128
				1,616

program. Production problem units in the job-oriented program included estimating, planning, plant layout, materials handling, dimensions, and tolerances.

Manufacturing processes, as taught in the job-oriented program, included laboratory experiences in machine shop and welding. Textbooks and motion pictures were provided as vicarious manufacturing experiences in the field-oriented program.

Mathematics, although offered under a single title in the job-oriented program, did include slide rule, algebra and trigonometry, which were separate courses in the field-oriented program.

Teaching Faculties

A total of 11 teachers were used in the job-oriented program, while 15 were used in the field-oriented program.

The drafting and design teacher in the job-oriented program was employed on a full-time basis. All others were part-time. The average number of students to each teacher in all job-oriented classes was 21. In Table 3.03 instructor data are summarized.

In the field-oriented program none of the instructors was employed on a full-time basis. The number of courses taught by individual teachers in this program varied from seven to one. The average teacher-student ratio in all field-oriented classes was one to 26.

In the job-oriented program, highest degrees held by teachers were in English (1), guidance (1), vocational education (1), and three fields of engineering (4). Highest degrees held by teachers in the field-oriented program were in mathematics (1), English (2), industrial arts education (1), drafting and design technology (3), and four fields of engineering (8).

Instructors in the job-oriented program were selected for their preparation in their subject field and for their experience allowing them to relate their subject field to industrial application. Faculty members employed in the field-oriented program had to be acceptable

to the University department responsible for the course being taught. For example, the Mathematics Department had to approve instructors for mathematics courses.

Examination of the data in Table 3.03 reveals few differences in the backgrounds of the teaching faculties. That there were six job-oriented teachers whose chief employment was in high school teaching and a like number of field-oriented teachers whose chief employment was in college teaching can be best explained by the location of the two programs in high school and college facilities.

Table 3.03

Education and Employment Experience of Teaching Faculties

Instructor Variables	Training Programs	
	Job-Oriented N=11	Field-Oriented N=15
Highest degree earned:		
Master's	3	2
Bachelor's	4	10
Associate		3
No college degree	1	
No data	3	
Chief Employment:		
Industry	4	4
College teaching		6
High school teaching	6	2
MDTA teaching	1	
Retired		3
Number having design, engineering, or related work experience	9	12
Average number of years of industrial work experience	16	15

Textbooks

A comparison of the two programs of instruction was made through an evaluation of the readability of the textbooks used. Employing an adaptation of the Flesch (1951) scale, developed by Johnson (1957),

the readability of the five textbooks used in the job-oriented and nineteen textbooks used in the field-oriented program was estimated. Based on the average number of syllables per 100 words and average sentence length of samples taken from each textbook, a mean reading ease score was determined. These are summarized in Table 3.04.

Of the nineteen textbooks used in the field-oriented program, ten were estimated to be "difficult," eight "fairly difficult," and one "standard." There were one "difficult," one "fairly difficult," and three "standard" books among the five textbooks used in the job-oriented program. A more thorough discussion of the textbook readability is presented by Bjorkquist and Kolker (1966).

Table 3.04

Mean Reading Ease Score for Textbooks

	Job-Oriented		Field-Oriented	
Style	Mean Reading Ease Score	S.D.	Mean Reading Ease Score	S.D.
Difficult			36	22.21
(Reading ease score			37	17.24
30-50)			40	10.72
(Grades 13-16)			43	19.12
			43	14.29
	45[1]	10.65	45[1]	10.65
			45	16.63
			48	10.68
			49	15.97
			49	11.13
Fairly difficult	50	16.09	50	11.33
(Reading ease score			50	13.75
50-60)			50	11.73
(Grades 10-12)			52	15.67
			52	4.80
			53	8.84
			56	10.02
			58	4.93
Standard	63	10.80	63	8.32
(Reading ease score				
60-70)	64	11.60		
(Grades 8-9)	65	10.78		

[1]Book used in both programs

There were very distinct differences in the number of textbooks used and in the reading ease of those books between the two programs. This may well indicate a difference in the level of technical competency strived for. However, the difference in number of textbooks was also an indication of the higher number of distinct courses taught in the field-oriented program. Additionally, faculty members associated with a university, as were the field-oriented staff, were probably more inclined to select from among college textbooks than were job-oriented faculty members. This may explain the more difficult readability level of the textbooks used in the field-oriented program.

Training Costs

The job-oriented training program was designed to accommodate 35 students, while the field-oriented program was for 40 students. By totaling the number of hours of instruction received by each student in each program, including dropouts, and dividing into the total instructional cost of each program, a cost per student hour of instruction was calculated. (The retention-dropout rate for the two training programs is discussed in Chapter IV.)

There were 56,326 student hours of instruction in the job-oriented program, at a total instructional cost of $31,488.94. The cost per student hours of instruction was $.5590.

In the field-oriented program there were 55,023 student hours of instruction, costing a total of $44,786.33. The cost per student hour of instruction was $.8139.

In neither the job-oriented nor the field-oriented program did instructional cost include the cost of allowances paid to individual students. These allowances were determined by the characteristics of the students and not by the nature of the training programs. Allowances paid to students were for subsistence, travel to and from home and school, and a training allowance paid to heads of households. In Table 3.05 the amounts of these allowances paid are shown.

Table 3.05

Allowances Paid Students

Type of Allowances:	Amount of allowances paid to students: Job-Oriented Program	Field-Oriented Program
Training	$ 49,112.80	$ 39,217.50
Subsistence	49,740.55	30,569.35
Transportation	6,700.00	11,771.76
Total	$105,553.35	$ 81,558.61

Summary

Administrators of both training programs reported that they could not develop their programs to fill their interpretations of job-oriented and field-oriented training as fully as they would have liked, because of the restriction of time on the programs. In other words, the 52 week limit on the length of the programs made the two programs more alike. However, the planning and operation of the two programs did suggest some differences in philosophical bases.

The involvement of individuals employed in industries utilizing tool design technicians in the planning of the job-oriented program linked that program to specific employment situations and the requirements for those jobs. The concern of the curriculum planners from industry for the employability and productivity of graduates in jobs conceptualized by them probably limited the breadth of preparation in favor of depth. Some breadth of preparation, however, was achieved because a curriculum fully acceptable to one industrial representative would not satisfy all.

The largely internal planning of the field-oriented program within the College of Engineering insulated it from the influence of specific industrial groups, and perhaps allowed it to be more oriented toward a broad occupational field. This procedure also seemed to remove the program from questions about the utility of

certain subject matter taught in the program. This too seemed to allow for the teaching of more basic subject matter having potentially wide application within a broad technical field.

Much of the subject matter included in the job-oriented program was intended to develop depth in tool design. Courses in manufacturing processes, applied physics, and production problems were taught to increase the students' understanding of the design process.

The division of time in the two programs of studies indicated a wider diversity of subject matter in the field-oriented program than in the job-oriented program. The field-oriented program included some product design and more machine design than the job-oriented program. The study of production problems in the field-oriented program was aimed more toward understanding industrial management than was the job-oriented program. The heavier loading of mathematics concepts in applied physics courses in the field-oriented program also suggested intent to develop technicians capable of making wider application of their technical skills.

Facilities used in teaching drafting and design in the job-oriented program were more like those found in industry than were those in the field-oriented program. Job-oriented students used drafting machines on drafting tables, while their counterparts in the field-oriented program used drawing board, T-squares, and triangles. The library in the job-oriented program, located in the drafting room, contained several vendors' catalogs, design reference books, trade journals, and technical handbooks, while the field-oriented library, located in the campus library, consisted of more academic holdings.

The difference in dropout rate suggested a difference in program objectives. Within the philosophies of job-orientation and field-orientation, successful training performance in a restricted or broader area of subject matter was required. There was insufficient evidence to say that one program had higher standards, was better taught, or motivated students better than the other. There did seem to be some difference in the concept of the type of skills

which would be required of graduates for successful job performance.

The process for the selection of faculty members differed for the two programs, but there were few differences in their education and employment experience.

Fewer textbooks were used in the job-oriented program and these were of lesser reading difficulty than textbooks used in the field-oriented program.

The average cost for each student hour of instruction in the job-oriented program was $.5590. In the field-oriented program the average cost per student hour of instruction was $.8139.

Observations of the planning and conduct of the job-oriented and field-oriented training programs did reveal some differences between the two programs. The purpose of these observations and the discussion of them has been to develop operational definitions of job-oriented and field-oriented education in mechanical technology as demonstrated in these instances.

CHAPTER IV

THE TRAINING PERFORMANCE OF STUDENTS

In the two previous chapters, the procedure for the selection of students, the characteristics of those students, and the characteristics of the training programs were described. The purpose of this chapter is to describe the performance of the students who entered training in terms of achievement measured by course performance and tests. The satisfaction of students with training, their vocational interests, and some of their self-perceptions are also reported here. Each of these variables was examined in an effort to determine what changes occurred in the students during the training programs.

During the first week of instruction in each of the two training programs, a half-day period was used for the administration of tests and inventories. The tests and inventories administered were:

Test of Word-Number Ability (Manuel et.al., 1957)
Purdue Industrial Mathematics Test (Lawshe & Price, 1946)
Revised Minnesota Paper Form Board Test (Likert & Quasha, 1941)
Test of Mechanical Comprehension (Bennett, 1951)
Sims SCI Occupational Rating Scale (Sims, 1952)
Minnesota Vocational Interests Inventory (Clark & Cambell, 1965)

The mean pretraining scores of the students who entered the two training programs are shown in Table 4.01.

Although there were no significant differences between groups in abilities as measured by the General Aptitude Test Battery, (See Table 2.02) there was a significant difference as measured by the Number section of the Test of Word-Number Ability. The mean Number score for the field-oriented students was significantly higher than that for the job-oriented students.

Among the 21 occupational and nine area scales of the Minnesota Vocational Interest Inventory the job-oriented group scored significantly higher than the field-oriented group on six scales. The interests of the job-oriented group were more like those of truck mechanics, industrial education teachers, sheet metal workers, plumbers, and machinists than were the interests of the field-

Table 4.01

Mean Pretraining Test Scores of Entrants to Training Programs

	Training Program			
	Job-Oriented N=35		Field-Oriented N=38	
Measure:	Mean	S.D.	Mean	S.D.
Test of Word-Number Ability				
Word Score	43.57	10.67	46.23	11.18
Number Score	23.14*	6.52	26.73*	7.60
Total	66.71	14.41	72.84	15.60
Purdue Industrial Mathematics	17.68	6.35	19.31	6.04
Minnesota Paper Form Board	44.51	9.74	45.07	7.88
Test of Mechanical Comprehension	28.62	9.01	29.42	8.94
Sims SCI	14.63	4.13	15.53	3.71
Minnesota Vocational Interest Inventory[1]				
Truck Mechanic	42.84*	8.68	36.17*	13.13
Industrial Ed. Teacher	39.94**	7.50	32.66**	13.25
Sheet Metal Worker	47.95*	7.56	42.73*	9.04
Plumber	40.15*	7.13	34.39*	11.99
Machinist	44.99**	9.02	36.78**	12.90
Outdoors	50.18*	6.94	46.71*	11.35

[1]Only those MVII scales on which there was a significant difference between groups are shown here.
*t value for difference between means significant at .05 level.
**t value for difference between means significant at .01 level.

oriented group. Additionally, the job-oriented students were more interested in outdoor activities than were the field-oriented students.

Periodically, throughout the training programs, students completed questionnaires designed to secure information about their satisfaction with the training programs and their aspirations relative to the field of mechanical technology.

At the conclusion of training, the battery of tests given at the beginning of training was again administered to all those students who remained in training. A Design Skills Test was administered at the conclusion of training.

Measures of Academic Achievement

Four standardized tests, one specifically designed test, and course grades earned during training were used as measures of academic achievement. Each of the tests used was selected because of its potential sensitivity to changes in the students, which, it was anticipated, might occur during the training programs. Because of the emphasis in drafting, mathematics, and mechanics, tests in these areas, together with a measure of verbal ability, were selected. Pretest and posttest scores are shown in Table 4.02.

Table 4.02

Pretraining and Posttraining Academic Achievement Scores For Program Graduates

	Training Program							
	Job-Oriented (N=30)				Field-Oriented (N=24)			
Measure:	Pretest		Posttest		Pretest		Posttest	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Test of Word Number Ability								
Word Score	42.97	10.71	46.80	11.30	46.79	11.91	48.00	12.74
Number Score	23.36**	6.39	30.00**	5.81	28.46	6.12	30.92	6.63
Total	66.33	14.92	76.80	15.25	75.25	14.60	78.92	12.92
Purdue Industrial Mathematics	17.93**	6.56	24.63**	3.89	20.75**	4.56	24.83**	4.16
Minnesota Paper Form Board	44.90	9.81	47.10	11.45	47.08*	6.12	50.79*	5.51
Test of Mechanical Comprehension	28.40*	8.36	33.70*	8.62	30.42	9.20	31.58	11.71

*t value for difference between means significant at .05 level.
**t value for difference between means significant at .01 level.

The N of 30 for the job-oriented program includes all those students who graduated from that program as tool designers. It does not include two students graduated as draftsmen. There were 25 graduates from the field-oriented program, however, complete test data were not available for one graduate. A visual comparison of

pretraining test scores for graduates of the two programs can be made with entrants into the two programs by comparing mean pretest scores in Table 4.02 with those in Table 4.01.

An examination of Table 4.02 shows that, with the exception of the Minnesota Paper Form Board, posttest means for the several measures of achievement for the two groups were closer together than were pretest means on the same measures. With each measure, there was some test score gain from pretest to posttest for both groups. Using pretest scores as a control, analysis of covariance was used to compare posttest scores for the two groups on each measure. There were no significant differences between groups on the selected measures of academic achievement.

At the conclusion of training, a Design Skills Test, specifically prepared as a measure of achievement for the two training programs, was administered. This test was prepared by educators, independent from the training programs, who had industrial experience in the field of mechanical technology. The test was divided into separately scored sections. A total score was also derived. Mean scores for job-oriented and field-oriented graduates are shown in Table 4.03.

On two sections of the Design Skills Test, the mean scores for the field-oriented graduates were greater than those of the job-oriented graduates. Neither of these differences was significant. On the other ten sections and on the total test, mean scores of the job-oriented graduates were greater than those of the field-oriented graduates. Mean scores for job-oriented graduates were significantly higher on seven individual sections and for the total test than they were for field-oriented graduates. Of the subject matter found in these seven sections, five were common to both programs of study.

The ability of the job-oriented graduates to perform better on the Design Skills Test may or may not have been related to their ability to perform on the job. The emphasis of the Design Skills Test

Table 4.03

Mean Scores on The Design Skills Test for Program Graduates

	Training Program			
	Job-Oriented		Field-Oriented	
	Mean	S.D.	Mean	S.D.
Drawings[1]	10.60**	2.58	8.27**	1.42
Material[1]	3.77	1.07	3.82	1.40
Personnel	6.20	1.00	6.50	1.26
Machine and hand tools	12.13**	2.19	10.05**	2.06
Mechanics[1]	20.43**	2.70	15.50**	2.91
Metallurgy	5.03**	1.19	2.91**	1.85
Heat	3.13	1.41	2.50	1.30
Mathematics[1]	6.50	2.62	5.59	1.97
Steels and heat treating[1]	7.87	.51	7.36	1.14
Die designing[1]	8.77*	1.31	7.41*	2.09
Die nomenclature (Blanking)[1]	12.07**	.83	10.14**	2.17
Die nomenclature (Compound)[1]	9.70**	3.64	5.50**	2.65
Total	106.53**	10.05	83.73**	11.31

[1]These areas were common to both programs.
*t value for difference between means significant at .05 level.
**t value for difference between means significant at .01 level.

appeared to be closer to the emphasis of the job-oriented curriculum than it was to the emphasis of the field-oriented curriculum. The test was not as broad as the field-oriented curriculum which included such subjects as industrial organization and management and engineering economics. Additionally, the applied nature of the items in the Design Skills Test was more similar to the job-oriented program than it was to the field-oriented program. However, of eight sections of the test in which subject matter common to both programs was found, job-oriented graduates scored significantly higher than field-oriented graduates on five sections.

There were 32 graduates from the 35 students admitted to the job-oriented program. Two of these students were designated as

drafting students, rather than design students because they failed courses in mathematics. They were allowed to continue in the program and graduate, however, two students were dropped because they exhibited a lack of motivation to apply themselves to the training. A third dropout was removed from training by the courts.

As mentioned previously, successful completion of courses taught in the field-oriented program was a determinent in retention of students. If prerequisite courses were failed, the student was not allowed to continue in the program of instruction. Of 40 students who entered the field-oriented program, there were 15 who did not graduate. Of these 15, 12 were dropped because they failed a course or courses prerequisite to continuation in the program. Ten of the 12 academic dropouts in this program failed a mathematics course or a course requiring the application of mathematics, such as kinematics. Three dropouts from the field-oriented program left for personal reasons.

Grade point averages were calculated using the number of hours of instruction in each subject area and the grades earned. For students dropped from training for academic failure, grade point average was calculated on the basis of failing grades for all incompleted courses. For students who dropped of their own accord, the GPA which they held at the time of dropping was used.Vocational

Vocational Interests

The Minnesota Vocational Interest Inventory was used as a measure of interests before and after training. This was an attempt to determine whether the intensive training programs would change the pattern of interests of the adult students enrolled. Mean pretest and posttest scores for graduates of the two programs are shown in Table 4.04.

There were differences in the pattern of interests of entrants into the training programs as shown in Table 4.01. However, there no differences in mean posttest scores for graduates when pretest scores were used as a covariate for analysis of covariance.

Table 4.04

Pretraining and Posttraining Vocational Interests for Program Graduates

Measure: Minnesota Vocational Interest Inventory	Job-Oriented N=30 Pretest Mean	S.D.	Posttest Mean	S.D.	Field-Oriented N=24 Pretest Mean	S.D.	Posttest Mean	S.D.
Occupational Scales								
Baker	32.87	6.40	35.00	7.12	36.83	9.03	36.18	8.70
Food Service Mgr.	35.20	5.97	37.17	7.39	35.63	6.06	35.00	7.10
Milk Wagon Driver	26.90*	5.07	29.80*	6.42	25.29**	9.23	32.82**	7.56
Retail Sales Clark	30.57	3.38	32.03	5.41	32.54	7.28	33.41	8.38
Stock Clark	43.87	5.43	44.57	6.69	43.67	7.63	45.82	8.09
Printer	32.63	6.42	34.40	7.99	32.92	8.79	32.50	8.63
Tab. Machine Oper.	35.73	7.63	36.57	7.74	34.46	7.23	35.27	8.49
Warehouseman	30.60	7.45	30.27	8.35	33.83	5.67	36.18	6.68
Hospital Attendant	35.93	4.99	35.10	4.69	37.33	7.29	38.32	8.39
Pressman	30.40	9.33	31.77	9.10	32.33	9.84	29.36	10.80
Carpenter	42.40	12.65	41.83	10.99	36.54	9.43	37.23	11.05
Painter	31.23	10.58	31.80	10.07	33.21	11.83	33.64	11.14
Plasterer	33.20	7.72	33.23	8.01	33.17	8.44	35.32	8.58
Truck Driver	27.57	7.75	28.10	7.52	30.17	11.34	31.68	10.77
Truck Mechanic	43.73	7.51	41.17	10.10	38.54	12.87	37.09	12.84
Ind. Ed. Teacher	40.30	8.08	37.93	9.09	33.83	12.24	31.55	11.52
Sheet Metal Worker	48.97	7.34	45.57	8.22	43.13	7.57	44.68	8.23
Plumber	40.90	7.41	36.50	11.92	34.96	11.93	34.36	11.22
Machinist	46.13	8.84	45.27	9.81	39.00	12.58	41.09	9.03
Electrician	28.87	13.05	25.50	14.75	29.29	12.74	24.77	12.01
Radio-TV Repairman	34.30	9.86	33.80	11.14	36.25	12.55	31.68	11.85
Area Scales								
Mechanical	51.50	6.43	50.17	7.40	49.33	9.80	47.23	10.44
Health Service	50.30	6.52	49.63	7.31	53.42	10.24	52.36	11.33
Office Work	49.57	8.29	52.30	9.24	49.58	6.42	51.23	9.15
Electronics	47.00	8.87	46.83	8.59	49.33	11.01	45.18	10.21
Food Service	50.07	8.84	53.93	10.64	49.92	7.37	50.86	9.55
Carpentry	52.63	9.50	49.40	9.31	46.33	9.73	49.32	11.18
Sales-Office	51.80	7.11	52.67	8.01	56.50	10.12	55.86	9.73
"Clean Hands"	50.60	10.91	50.10	10.38	50.71	11.80	49.32	9.25
Outdoors	51.07	6.30	48.83	8.65	48.96	13.72	49.18	9.22

*t value for difference between means significant at .05 level.
**t value for difference between means significant at .01 level.

Between pretest and posttesting, significant gains were made by both groups on the "Milk Wagon Driver" scale. One might surmise that the orderlines observed in milk wagon drivers and draftsmen-designers was related to this change.

Social Class Identification

Since students entering the training programs came from various states of unemployment and underemployment it was anticipated that a training program to prepare for new employment might change the self-perception, particularily the social class identification of the individuals involved. For this reason the Sims SCI Occupational Rating Scale was used in the pretest and posttest battery. Mean scores for graduates of the two training groups are shown in Table 4.05.

Table 4.05

Pretraining and Posttraining Social Class Identification Scores for Program Graduates

	Training Program							
	Job-Oriented N=30				Field-Oriented N=24			
	Pretest		Posttest		Pretest		Posttest	
Measure:	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Sims SCI Occupational Rating Scale	14.17	4.94	16.53**	3.70	14.80	3.28	18.84**	3.72

**Covariate F value significant at .01 level.

These scores may be compared with scores of the norm group reported by the author of the scale. The mean score of the norm group was 17.3 for high school students and 21.3 for college students, according to Sims (1952). Using pretest means as a control, there was a significant difference in posttest means with field-oriented graduates scoring higher on the social class identification scale after training.

A comparison of Tables 4.05 and 4.01 indicates the difference in pretest means for graduates and entrants in the job-oriented and field-oriented programs.

Variables Correlated With Grade Point Average

In an earlier section of this chapter, the way in which grade point averages for individual students were calculated was reported. These grade point averages were used as a criterion of success in training to determine the relationship between several psychological measures[1], selected biographical data[2], and criterion. These correlations are shown in Tables 4.06 and 4.07.

Table 4.06

Multiple Correlations Among Selected Variables and Grade Point Average for Entrants Into Job-Oriented Program

	Multiple Correlation Coefficient	Fraction of Explained Variance
Age + Paper Form Board+ GATB (Spatial) + Industrial Math Test ⟶ GPA	0.6781	0.460
Paper Form Board + GATB (Spatial) + Industrial Math Test ⟶ GPA	0.6733	0.453
GATB (Spatial) + Industrial Math Test ⟶ GPA	0.6362	0.405
Industrial Math Test ⟶ GPA	0.5706	0.326

[1]Purdue Industrial Mathematics Test, Mechanical Comprehension Test, Minnesota Paper Form Board, Test of Word-Number Ability, and GATB (General, Numerical, and Spatial).

[2]Level of Mathematics education, years since last mathematics course, and age.

Table 4.07

Multiple Correlations Among Selected Variables and Grade Point Average For Entrants Into Field-Oriented Program

	Multiple Correlation Coefficient	Fraction of Explained Variance
Age + Years since last math course + Mechanical Comprehension + Number Ability ⟶ GPA	0.6889	0.475
Years since last math course + Mechanical Comprehension + Number Ability ⟶ GPA	0.6475	0.419
Mechanical Comprehension + Number Ability ⟶ GPA	0.5894	0.347
Number Ability ⟶ GPA	0.5001	0.250

In the case of each program it was possible to explain a little less than one-half of the variance in the criterion. Interestingly, there was only one common variable for the two programs, which in each instance was the first one to drop out. This common variable was age. A detailed analysis of the predictors of mathematics achievement is presented by Finch (1968).

Students Attitudes Toward Training

Periodically, throughout the training programs, questionnaires were given to students to record their reactions to various aspects of the programs. Questions designed to determine the student's satisfaction and desire to persist in the occupational field for which he was being trained, together with questions about study habits, were asked.

Three questions were used at two different times during training to gather information about student's satisfaction and desire to persist in the occupational field for which they were being trained. The questions, the time they were asked, and the responses are shown in Tables 4.08, 4.09, and 4.10.

In Table 4.08, responses indicated whether students would choose the training program again. All students in the job-oriented program responded positively each time, while two students in the field-oriented program responded negatively on each occasion. The smaller N for each program during the twelfth month of training was because of dropouts in the programs. There were no significant differences

Table 4.08

Knowing What You Do About This Training Program, Would You Apply For It Again, If You Had The Choice To Make Over?

	Training Program							
	Job-Oriented				Field-Oriented			
Time of Question:	Yes	I think so	I don't think so	No	Yes	I think so	I don't think so	No
Second month of training	33	2	0	0	24	9	0	2
Twelfth month of training	28	4	0	0	17	4	1	1

in responses of the two groups to the question about choosing the training program again.

Table 4.09

From Your Experience in the Program is it What You Had Expected Before You Enrolled?

	Training Program							
	Job-Oriented				Field-Oriented			
Time of Question:	Definitely	Almost	Somewhat	Very Little	Definitely	Almost	Somewhat	Very Little
Second month of training**	20	11	1	1	8	14	10	3
Twelfth month of training*	17	11	6	0	7	5	8	3

*Chi square value for difference between groups significant at .05 level.
**Chi square value for difference between groups significant at .01 level.

The responses reported in Table 4.09 indicated the degree to which the training programs met the expectations of the students. At both times when the question about program expectations was asked there were significant differences in the responses of the two groups of students. The differences in responses at the second month of training were significant at the .01 level, when tested using chi square. Differences in responses at the twelfth month of training were significant at the .05 level. In both cases the job-oriented program was more in keeping with the expectations of students than was the field-oriented program.

Table 4.10
As You Look Ahead to the Future, Do You Think That You Would Like to Remain in Machine or Tool Designing or a Closely Related Field?

	Training Program							
	Job-Oriented				Field-Oriented			
Time of Question:	Re-main	More Tech.	Less Tech.	Not Related	Re-main	More Tech.	Less Tech.	Not Realted
Eighth month of training*	9	24	0	0	6	17	6	1
Twelfth month of training**	11	20	0	0	1	18	2	2

*Chi square value for difference between groups significant at .05 level.
**Chi square value for difference between groups significant at .01 level.

Students were asked to indicate whether they would like to: 1) remain in machine or tool designing, 2) work toward a related job which may be more technical or with more responsibility such as engineering or supervision, 3) work toward a related job which may be less technical or with less responsibility, such as drafting or a machinist's job, or 4) work at a job not related to machine or tool design.

There were significant differences in the responses of the two training groups to the question both times it was asked, as shown in Table 4.10. During the eighth month of training the responses were significantly different at the .05 level. During the twelfth month the responses were significantly different at the .01 level. In each instance the job-oriented students expressed more desire to remain in machine or tool design than did the field-oriented students. There were some field-oriented students who wanted less technical or unrelated jobs while none of the job-oriented students did.

Student Study Habits

Because of the intensity of the training programs and some of the personal characteristics of the students, the study patterns of students were investigated. Students reported how much time they spent in study, whether they studied with others, what subjects they studied with others, and whether they had developed a plan for studying. They were also asked to report how difficult they considered their out-of-class assignments to be.

Job-oriented students reported that they spent an average of 1.8 hours each day and 2.4 hours each weekend in out-of-class study. Field-oriented students reported an average of 2.3 hours each day and 3.0 hours each weekend in out-of-class study.

Among job-oriented students, 31 of 35 studied with others. All those who reported studying together reported that mathematics was one of the subjects they studied with someone else. Nineteen of 37 field-oriented students reported studying with other students. Most often, mathematics and industrial engineering were studied with others.

Eighteen job-oriented and 16 field-oriented students reported that they studied according to a plan.

Students were asked how difficult they considered the homework assignments to be. Their responses are shown in Table 4.11.

Table 4.11

How Difficult Have The Homework Assignments Been?

Difficulty:	Training Program Job-Oriented**	 Field-Oriented**
Very difficult	3	0
Difficult	10	3
Moderately difficult	20	25
Easy	2	9

**Chi square value for difference between groups significant at .01 level.

The estimates of the difficulty by students in the two programs were significantly different from each other at the .01 level with the job-oriented students reporting their homework as more difficult than did the field-oriented students.

Summary

The primary purpose of this chapter was to describe what changes occurred in the students enrolled in the job-oriented and field-oriented programs during the year of training. There was some evidence that interests played a part in the selection of a training program by an individual. There were some significant differences in measured interests between the group enrolled in the job-oriented program and the field-oriented enrollees. There was also a significant difference between groups on a measure of numerical ability.

There was additional support for the idea that the interests of students determined, in part, the training program they entered. The job-oriented program was described as including machine shop practice and as emphasizing application. Students who entered this program expressed interests more like persons in mechanical occupations - truck mechanic, sheet metal worker, plumber, and machinist.

Four standardized tests were used as measures of academic achievement. Each one was administered before and after training. There were gains in scores on each test for each group between pretesting and posttesting. Using pretests as a covariate, analysis of covariance was used to compare posttest means. None of these mean differences was statistically significant.

A specifically prepared Design Skills Test was administered at the conclusion of training. The mean total score and mean scores on seven sections of this test were significantly higher for the job-oriented than for the field-oriented group. This may indicate that the job-oriented students were better prepared or it may mean that the test was more job-oriented than field-oriented. However, of eight test sections containing content common to both programs, job-oriented graduates scored significantly higher on five.

There were 15 dropouts from the field-oriented course and three from the job-oriented course. Twelve of the field-oriented dropouts and none of the job-oriented dropouts were for reason of academic failure. This reflected, primarily, a difference in philosophy of retraining. In the field-oriented program, all students were required to achieve the standard while in the job-oriented program those who could not achieve the standard for tool design were placed on another track with a somewhat less technical occupational objective.

A measure of social class identification was used as a pretest - posttest. There was a tendency for students to place themselves higher, occupationally, following training, but there was no difference between posttest means for the two groups when compared by analysis of covariance.

As reported by students in questionnaires, job-oriented students found the training program more nearly met the expectations they had formed before entering than did field-oriented students. This may be because the pre-training interviews and orientation better described the job-oriented program or may indicate that the

job-oriented students were better satisfied with the program. Job-oriented students also reported a greater desire to remain in machine or tool design or a more technical field than did field-oriented students.

Students from each program reported spending 1.8 or more hours each day plus 2.4 or more hours each weekend studying out-of-class. Most of the job-oriented and about half the field-oriented students studied cooperatively with others. A few less than one-half of all the students reported studying according to a plan. Job-oriented students estimated that their homework assignments were more difficult than did field-oriented students. Difficulty and amount of time spent on assignments did not seem to be equated by students. There may have been some ego involvement in estimating the difficulty of the homework.

Several psychological and biographical variables were correlated with grade point average earned in training. Perhaps the most pertinent point that can be made about these correlations is that the factors correlating best in the job-oriented program were different from those correlating best in the field-oriented program. In the job-oriented program two measures of spatial ability and a measure of mathematical ability remained in the equation longest, while in the field-oriented program a measure of numerical ability and a measure of mechanical comprehension remained longest.

CHAPTER V

THE PLACEMENT PROCEDURE AND THE FIRST JOB

Three months before students were to be graduated from the training programs, efforts were begun to place them in employment. The purpose of this chapter is to describe that placement procedure and several aspects of the first jobs secured by graduates. Length of time to secure the first job, skills used in that job, satisfaction with the job, salary, and mobility were investigated.

Placement of Graduates

Placement of program graduates in jobs was considered to be a measure of the success of the program itself. It was also recognized that this measure was susceptible to efforts expended in the placement process. To increase the similarity in the placement procedure for the two programs, the research staff engaged in some placement activities in behalf of both the job-oriented and field-oriented students.

Through consultations with the research steering committee and officials of the Pennsylvania Bureau of Employment Security it was decided to prepare brochures describing the training programs. These brochures were to be given to prospective employers. Each brochure described the purpose of the program, the selection of trainees and their characteristics, and the course of study in the training program. Information was given about the availability of trainees for employment and how employers might contact students.

Brochures were distributed by the Pennsylvania State Employment Service, students, and the schools. The Employment Service did not anticipate that there would be sufficient requests for machine and tool designers through regular vacancy announcements made to them. For this reason, job development by local office personnel was recommended. Using the brochures to acquaint prospective employers with the training programs, Employment Service representatives could locate jobs for graduates. Students also arranged interviews for themselves. Several companies seeking employees

visited the sites of the two training programs. In Table 5.01, method of referral to first industrial job is shown.

Table 5.01

How Students Were Referred to Their First Jobs

	Training Program	
	Job-Oriented N=27	Field-Oriented N=20
Method of Job Referral:		
Personal contact	4	4
Retraining program personnel	11	4
Personal friend or contact	4	1
Pennsylvania State Employment Service	4	2
Public News Media	4	7
No data	0	2

Although 26 graduates reported to work immediately after training, it required an average of almost four weeks (3.93 job-oriented, 3.76 field-oriented) for them to begin their first job. The time required by industry for the screening and selection of individuals they hired for technical positions was reflected by this four week figure. Time lapse from initial job application to beginning work often was two or more weeks.

The First Job

The first contacts with graduates and dropouts of the job-oriented and field-oriented programs was made six months after graduation. Interviews were conducted with graduates to provide baseline data about several aspects of their jobs. Some of this data, such as starting salary, refers to initial employment, while data such as job satisfaction must be assumed to refer to the time the data was gathered. Seventy-three of the original 75 who began training were accounted for at the time of the first interview. Their employment status is shown in Table 5.02.

During the first interview contact, a job analysis was completed and data on job satisfaction, mobility, unemployment and salary were gathered.

Table 5.02

Employment Status Six Months After the End of Training

	Employed					
	Industry	Military	Student	Unemployed	No Data	Total
Job-Oriented						
Graduates	27	2	0	1	0	30
Dropouts	4[1]	0	0	0	1	5
Total	31	2	0	1	1	35
Field-Oriented						
Graduates	20	3	2	0	0	25
Dropouts	9	4	0	1	1	15
Total	29	7	2	1	1	40

[1]Includes two students graduated as draftsmen.

Job Responsibilities

A job analysis was used to gather data about skills used on the job, work aids used, work field, and to describe job functions. The analysis technique used was one structured by the United States Bureau of Employment Security and used in their preparation of the 1965 Edition of the Dictionary of Occupational Titles (Dictionary, 1965).

Each interview required about 45 minutes, of which, approximately 30 minutes were spent for the job analysis. By observing the output of the worker and asking questions about what he did, how and why he did it, and what skill was involved the job analyst prepared a job description. A sentence analysis of each job description was prepared to identify the worker's function, relative to data, people and things. In general a hierarchy has been established in each of these three areas in which a lower code

number identifies a higher level of involvement required by the job. Thus a job of compiling data requires a higher level of involvement by the worker than does a job of computing. (See Table 5.03) The code numbers derived by use of the hierarchy constitute digits 4, 5, and 6 of the six digit DOT code number.

Table 5.03

Level of Complexity at Which the Job Required the Worker to Function

Data	People	Things
0 Synthesizing[1]	0 Mentoring	0 Setting-Up
1 Coordinating	1 Negotiating	1 Precision Working
2 Analyzing	2 Instructing	2 Operating-Controlling
3 Compiling	3 Supervising	3 Driving-Operating
4 Computing	4 Diverting	4 Manipulating
5 Copying	5 Persuading	5 Tending
6 Comparing	6 Speaking-Signaling	6 Feeding-Offbearing
7 No Significant Relationship	7 Serving	7 Handling
8 No Significant Relationship	8 No Significant Relationship	8 No Significant Relationship

[1](Dictionary, 1965, pp. 649-650)

The most difficult judgments concerned the worker's level of involvement with data. Operationally, the worker's responsibility in making decisions was used to determine his data involvement. For example, a worker who manipulated data and then referred to a company reference manual for a prescribed action was considered to be "computing" data. If his job required that he collect and summarize data, report these data, and carry out an action based on this, he was considered to be "compiling" data.

Although none of the jobs analyzed required the worker to perform in isolation, seldom was a specialized skill in dealing with people necessary to the performance of the job. In a few instances workers were required to direct the activities of others at the "speaking-signaling" level.

All jobs requiring the use of drafting instruments were considered to be at the "precision working" level with things.

Of 27 job-oriented graduates employed in industry, 25 were employed in the area of drafting and engineering. Two others were employed as inspectors. Sixteen of those employed in drafting and engineering held jobs which required them to compile data. Only two individuals had jobs requiring a significant involvement with people at the speaking-signaling level. Precision working with things was involved in the jobs of 24 of the 25 graduates employed in drafting and engineering jobs. The jobs performed by 14 job-oriented graduates in drafting and engineering required a level 3 (compiling) involvement with data, a level 8 (no significant relationship) involvement with people, and a level 1 (precision working) involvement with things.

Eleven of 20 field-oriented graduates working in industry, were employed in drafting and engineering. Other graduates were employed in three other work fields - machining, researching, and investigating. Nine of those employed in drafting and engineering compiled data. One of the eleven in drafting and engineering held a job requiring speaking-signaling with people. All others were not required by their jobs to be significantly involved with people. Precision working with things was required in all the jobs. Eight of eleven field-oriented graduates employed in drafting and engineering performed jobs requiring a level 3 involvement with data, a level 8 involvement with people, and a level 1 involvement with things. In other words, the worker was required by his job to compile data, have no significant relationship with people, and to precision work with things. An example of a job description at the .381 level was this one.

I. Designs and redesigns tools, jigs, fixtures, and machines for use in production of cutting tools.

(A-D 30%)
- A. Receives verbal and/or written instructions from design supervisor.
- B. Determines metal thickness, tolerances and appropriate hardware to be used.
- C. Consults vendors catalogs, company tool and process standards manuals.

D. Calculates design dimensions using algebra and trigonometry, slide rule and desk calculator.

(5%) E. Measures existing tools and machinery where necessary using micrometer and calipers.

(60%) F. Drafts design for tool using drafting board and equipment.

(5%) II. Catalogs and standardizes tooling information in completed designs.

Part of the job analysis was the determination of skills used on the job. Each graduate was asked what drafting, design, and mathematics skills he used. Responses indicated that graduates of the job-oriented program used more of the drafting skills as shown in Table 5.04. Ninety-three percent of the job-oriented and eighty-three percent of the field-oriented graduates used some drafting skill. It should be noted that all those using drafting skills were not employed as draftsmen or designers. Some expressed the value of drafting skills in communicating ideas with fellow workers.

Table 5.04

Percentage of Graduates Using Drafting Skills

	Training Program	
Drafting Skills	Job-Oriented N=27	Field-Oriented N=20
Freehand Lettering	93	78
Sketching	89	67
Orthographic Projection	79	78
Sectioning	86	78
Auxiliary Views	86	55
Revolutions	46	39
Dimensioning	89	72
Scale Drawings	89	78

In Table 5.05 a summary of design skills used by graduates is shown. Approximately the same percentage of job-oriented graduates (75 per cent) as field-oriented graduates (72 percent) were using some design skill. Larger percentages of job-oriented graduates were

designing fixtures, jigs, dies, and cutting tools. The design phase of instruction in the job-oriented course had emphasized the designing of these types of tooling, particularly fixtures and jigs. The design emphasis in the field-oriented course had been broader.

Table 5.05

Percentage of Graduates Using Design Skills

Design Skills	Training Program: Job-Oriented N=27	Training Program: Field-Oriented N=20
Fixtures	57	39
Jigs	50	28
Molds	4	11
Dies	25	6
Machines	21	28
Tools	46	33
Layout	39	44
Products	11	17

Some form of mathematics was used on the job by all graduates of both programs. As indicated in Table 5.06, the training stress on trigonometry and the foundation subjects of arithmetic, algebra, and plane geometry was paralleled by the mathematics of the job. Calculus was not used by any graduate and was not taught in either program.

Table 5.06

Percentage of Graduates Using Mathematics Skills

Mathematics Skills	Training Program: Job-Oriented N=27	Training Program: Field-Oriented N=20
Arithmetic	100	94
Algebra	75	78
Plane Geometry	71	83
Solid Geometry	18	33
Right Triangle Trigonometry	89	83
Oblique Triangle Trigonometry	75	66
Calculus	0	0

Work aids used by the majority of graduates employed in drafting and engineering were in descending order of frequency of use: drafting equipment, mathematical tables, technical handbooks, vendor's catalogs, company specification manuals, drafting machines, desk calculators, and slide rules. Other work aids used by more than five graduates were: parallel bars, micrometers, calipers, machinist gages, and dial indicators.

Job Satisfaction

Satisfaction on the job was another aspect of investigation during the follow-up of graduates. The Job Description Index (Hulin & Smith, 1964, Smith, 1962) was used to measure satisfaction with five phases of the job. Workers indicated their positive, negative, or undecided attitude toward a series of words about supervision, promotion, work, pay, and people as these were associated with their jobs. Based on these responses, scores were derived for each of the five scales as shown in Table 5.07. The area of least satisfaction was "pay," while "work" provided the greatest satisfaction.

Table 5.07

Job Satisfaction Scores for Graduates

	Training Program			
	Job-Oriented		Field-Oriented	
	Raw	Percentile[1]	Raw	Percentile[1]
Supervision	48.6	70	49.5	65
Promotion	20.4	65	20.2	65
Work	46.9*	90	41.8*	70
Pay	15.2	40	17.7	50
People	49.4	65	49.0	60

[1]Percentiles based on scores of vocational high school graduates
*t value for difference between means significant at .05 level.

Mobility

For the purposes of this study mobility was defined in terms of changing both residence and job. A graduate was considered to have made a horizontal move when he changed his residence and his

job at the same time. Of 27 job-oriented graduates employed in industry, eight changed their place of residence to secure their first job. Percentage-wise more than twice as many (65 per cent) in industry from the field-oriented program changed their place of residence after completion of training than did those from the job-oriented course (30 percent). There was a significant ($p<.01$) difference in the mean number of weeks (.81 weeks) required for those who moved to secure their first job from those who didn't (5.53 weeks).

An analysis of variance was used to determine whether there was a difference in the mean age of those who moved as opposed to those who did not. The difference in the mean age of graduates of the two programs employed in industry was also tested. (See Table 5.08)

Table 5.08

Mean Ages of Mobile and Immobile Graduates Employed in Industry

	Training Program		
	Job-Oriented	Field-Oriented	Total
Graduates who moved to take first job	22.75 (8)[1]	21.92 (13)	22.23* (21)
Graduates who did not move to take first job	25.36 (19)	27.00 (7)	25.81* (26)
Total	24.59 (27)	23.70 (20)	

[1]N shown in parantheses.
*F value significant at .05 level.

The mean age of the 21 graduates of both programs who moved to secure their first job was 22.23 years and the mean age of the 26 graduates who did not move to secure their first job was 25.81 years. This difference in mean ages was significantly different. The mean ages of graduates of the two programs was not significantly different.

Married graduates did not move any more or less to secure their first job than did the single graduates.

Salaries

Another interesting aspect of the jobs performed by graduates of the two training programs was the salaries they earned. The average beginning salary for graduates of the field-oriented program was $110.00 per week, while job-oriented graduates averaged $96.81 per week. The modal salary for field-oriented graduates was $124.50 per week. This salary was earned by seven graduates who began work with the same employer. The modal salary for job-oriented graduates was $104.50, earned by eleven men. Six field-oriented graduates also earned $104.50 per week. The range in weekly beginning salaries for both programs was from $64.50 to $154.50.

The mean salary of those who moved to secure their first job after graduation was $112.60 per week, while those who didn't move to secure their first job earned an average of $94.10 per week. (See Table 5.09) This difference and the difference between the salaries of the graduates of the two programs were tested.

Table 5.09

Mean Beginning Weekly Salaries of Mobile and Immobile Graduates Employed in Industry

	Training Program**		Total
	Job-Oriented N=27	Field-Oriented N=20	
Mobility**			
Mobile	$110.75	$119.88	$112.60
Immobile	95.01	91.51	94.10
Total	$ 96.81	$110.00	

**F value for interaction between training program and mobility significant at .01 level.

The interaction between program and mobility was significant, complicating the interpretation of the main effects, program and mobility. The mean starting salary for field-oriented graduates who moved was $119.88 per week and for those who didn't move $91.51 per week. For job-oriented graduates who moved the mean starting salary was $110.75 per week and $95.01 per week for those who didn't move to secure their first job. In other words, there was a greater starting salary advantage for field-oriented graduates who moved to secure their first job than their was for job-oriented graduates who moved. Job-oriented graduates who did not move earned more than field-oriented graduates who did not move.

Additional Training

Of the 47 graduates of the job-oriented and field-oriented programs employed in industry, 18 were involved in some type of on-the-job training. The on-the-job training varied but included a planned rotation among sections within a design department under the supervision of the section chiefs, to assignment to a senior designer who was responsible for inducting the new employee. In two plants, formal in-plant classes were held for the new designers and draftsmen.

Summary

Of the 75 men who began training, 60 were accounted for as industrial employees. Another nine were serving in the armed forces. Two had entered college. High percentages of the 47 graduates employed in industry were using, on the job, one or more phases of the specialized training they received. This was indicated by percentages using orthographic projection, sectioning, auxiliary views, dimensioning and scale drawing. The percentages involved in designing fixtures, jigs, machines, tools, and layouts further indicated that subject matter taught in the training programs was being used on the job. The utility of the specialized mathematics instruction was indicated by

percentages of graduates using algebra and trigonometry. Of the 47 graduates employed in industry, 36 were employed in drafting and engineering jobs.

The most common work aids used on the job included drafting instruments, several reference books, and drafting machines. Both slide rules and desk calculators were commonly used.

By use of a job analysis, the graduates' level of involvement with data, people, and things, as required by their jobs was determined. Of the 36 employed in the area of drafting and engineering 25 held jobs which required them to compile data. Precision working with things, (in this case drafting instruments) was required in the jobs of 34 of the 35 in the field of drafting and engineering. The performance of the jobs of three persons employed in drafting and engineering required significant involvement with people. This involvement was at the speaking-signaling level.

In terms of fields of work, field-oriented graduates held a greater diversity of jobs than did job-oriented graduates. Twenty-seven industrially employed job-oriented graduates were in drafting and engineering and two were inspectors. Eleven of 20 field-oriented graduates were employed in drafting and engineering with the remainder being employed in three other work fields.

The experience with this research project indicated that the transition from training to work was a problem area. Although 26 of the 47 graduates who secured employment in industry within six months after graduation had no period of unemployment following training, it required an average of almost four weeks for all the graduates to begin their first job. This occurred in spite of the coordinated placement efforts that were carried out. The period of time required by industry to screen and select individuals for hiring was suggested as one possible reason. Individuals who did not move to secure their first job experienced a longer period of unemployment following graduation. The number of referrals made to jobs through informal contacts seem to

indicate that training program graduates could have been helped more in securing their first jobs.

There was a wide variance in the beginning weekly salaries earned by graduates. It appeared that there was a greater salary advantage for field-oriented graduates who moved as opposed to job-oriented graduates who moved. This difference is difficult to explain. It is possible that field-oriented graduates were offered more incentives for moving because of the national reputation of the program with which the field-oriented program was associated. On the other hand, the places to which field-oriented graduates moved may have provided them with a salary advantage which mobile job-oriented graduates did not enjoy. The question of the interaction between mobility and training programs relative to salaries remains unanswered.

Job satisfaction scores indicated that the two groups of graduates were quite well satisfied with most aspects of their jobs. It can be speculated that the job-oriented graduates were more satisfied with the "work" aspect of their jobs because they were more nearly working at the level for which they were prepared than the field-oriented graduates. If the field-oriented graduates considered their work to be beneath their level of preparation, their satisfaction with "work" should increase as the level of responsibility of their jobs increases. (See Chapter VI.)

Observation indicated that the primary in-plant educational provision for new employees was to indoctrine them into the workings of that company and plant. Little, if any, education in basic drafting and design skills were available.

CHAPTER VI

THE CONTINUING JOB: SECOND AND THIRD FOLLOWUPS

The purpose of this chapter is to describe the employment of graduates of the job-oriented and field-oriented training programs during the first two years following training. Data were gathered primarily through interviews conducted approximately one year and two years after graduation. One or two interviews were conducted with 28 job-oriented design graduates, and 20 field-oriented graduates. The employment status of graduates of the programs one and two years after the completion of training is shown in Table 6.01.

Table 6.01

Employment Status of Graduates One and Two Years After the Completion of Training

Job-Oriented:	Industry	Military	Student	Unemployed	No Data	Total
One year after graduation	27[1]	3	0	0	0	30
Two years after graduation	28[1]	2	0	0	0	30
Field-Oriented:	**Industry**	**Military**	**Student**	**Unemployed**	**No Data**	**Total**
One year after graduation	20	3	2	0	0	25
Two years after graduation	17	4	0	1	3[2]	25

[1]There were two additional job-oriented students graduated as draftsmen employed in industry.

[2]Three individuals were in the process of making geographic moves at the time of interviewing and were not available for interviews.

Beginning three months after the completion of training, and quarterly following that, a newsletter, Design Alumni News, was prepared and distributed by the research project staff. This

newsletter was intended to maintain contact between former students and the research staff. Each newsletter contained personal items about former students and reports on the research project. The newsletter was distributed to former students, faculty members, employers of graduates and others interested in the research project.

During the second and third follow-up interviews, a job analysis was completed and data about unemployment, mobility, additional education, salary, and job satisfaction were gathered. Each graduate was rated by his supervisor and each graduate rated the utility of the courses he completed during training. On the third interview each graduate completed a social class identification scale identical to the one completed just before and just after training.

Social Class Identification

With a shift in occupations, as provided for in a retraining program, it was hypothesized that there would be a shift in social class identification as identity with the new occupation developed. Prior to training and immediately after training, students completed the Sims SCI Occupational Rating Scale (Sims, 1952). This scale was again administered to graduates two years after the completion of training. The scale contained a list of 42 occupations which the individual rated as socially higher, lower, or the same as his own occupation. Scores represented the number of occupations rated lower plus one-half the occupations rated the same by the individuals. Mean scores for both training groups are shown in Table 6.02.

Scores for each of the groups were lowest before training and highest immediately after training. Two years after training, scores had declined from immediately after training. There was a change in scores during training in the anticipated direction, but this change did not continue during the first two years on the job as had been expected.

Table 6.02

Social Class Identification Scores for Job-Oriented and Field-Oriented Graduates Pretraining, Post Training and Two Years After Graduation

	Job-Oriented (N=28)		Field-Oriented (N=15)	
	Mean	S.D.	Mean	S.D.
Pretraining	14.07[1]	3.60	14.07[2]	3.52
Posttraining	16.21[1]	3.18	18.87[2]	3.92
Graduation + Two Years	15.82	2.45	17.53	2.15

[1]F value for difference between means significant at .01 level.
[2]F value for difference between means significant at .01 level

Job Responsibilities

The purpose of the job analysis was to gather data about what the worker did, how and why he did it, and what skill was involved. The analysis procedure, more thoroughly described in Chapter V, was developed by the United States Bureau of Employment Security and was used in gathering data for the 1965 Edition of the Dictionary of Occupational Titles. (Dictionary, 1965)

Twenty-four job-oriented and 15 field-oriented graduates were employed in the work fields of drafting and engineering one year and two years after training. (See Table 6.03) These were jobs in which the individuals had varying responsibilities designing and drafting. Those graduates in the work field of researching were involved primarily in data collection in engineering experimentation. The individuals in the work field of appraising were working as inspectors. The individual in administering was responsible for negotiating contract changes. One individual was a materials handler in the field of loading-moving. Three graduates operated machines in the field of machining.

Table 6.03

Work Fields of Graduates Employed in Industry One and Two Years After Training

	Training Program			
	Job-Oriented		Field-Oriented	
Work Fields[1]	1 year (N=27)	2 years (N=28)	1 year (N=20)	2 years (N=17)
Drafting and Engineering	24	24	16	15
Researching	0	1	1	0
Appraising	1	2	0	0
Administering	1	1	0	0
Loading-Moving	1	0	0	0
Machining	0	0	3	2

[1](Work performed manual, 1959)

The jobs of all 24 job-oriented graduates employed in drafting and engineering one year after training required computing or compiling of data, speaking-signaling or no significant relationship with people, and precision working with things.[1] One year later, the level of involvement with data had increased for six individuals and decreased for one. Five individuals held jobs requiring the analyzing of data. Between one and two years after training the level of involvement with people had increased for five job-oriented graduates. Two individuals were responsible for persuading people and five others had speaking-signaling responsibilities.[2] All job-oriented graduates in drafting and engineering continued precision working with things two years after training.

[1]Speaking-Signaling responsibilities included assigned responsibilities to coordinate with others and may have included giving assignments or directions to helpers or assistants. Although most graduates were involved in conferring with others, this was usually a part of the data gathering process and was not considered to require specialized skill in dealing with people. Those using persuading skills with people were involved in influencing customers in favor of product modifications to increase efficiency of production.

[2](Dictionary, 1965, pp. 649-650)

There were 15 field-oriented graduates employed in the work fields of drafting and engineering one and two years after training. After one year on the job, three graduates were analyzing data, eleven were compiling data, and one was copying data. After two years at work, the level of involvement with data had increased for two persons and had decreased for one. One year after the completion of training one graduate was persuading people, five had speaking-signaling responsibilities, and eight had no significant relationship with people. A year later the level of responsibility in dealing with people had increased for three field-oriented graduates. One year after the completion of training one graduate in the work field of drafting and engineering was responsible for handling things.

All other graduates, one and two years after training, were responsible for precision working things. There was no significant difference in the number of graduates of the two programs in the levels with which they worked with data, people, and things two years after the completion of training.

With the exception of one graduate, who was in the work field of loading-moving one year after the completion of training, all graduates used many of the work skills which were specifically taught in the training programs. This was evidenced by their job descriptions and by their use of drafting, designing, and mathematics. Percentages of industrially employed graduates using these skills one and two years after the completion of training are shown in Tables 6.04, 6.05, and 6.06. Also shown in these tables are the percentages of graduates using none of these skills.

Changes in the percentages of graduates using the various drafting skills which occurred between one year and two years after training were relatively small. The largest percentage of change was in the use of graphs by field-oriented graduates. Eleven percent used graphs one year after training and 50 percent used them a year later. In actual numbers this percent increase equals six individuals. The drafting skills used by the largest percentages

Table 6.04

Percentage of Graduates Using Drafting Skills One and Two Years After Training

Drafting Skill	Job-Oriented One Year (N=27)	Job-Oriented Two Years (N=28)	Field-Oriented One Year (N=19)	Field-Oriented Two Years (N=16)
Freehand lettering	89	93	84	100
Sketching	85	93	95	94
Pictorial drawings	74	68	58	75
Orthographic drawings	81	86	68	74
Sections	85	89	68	94
Dimensioning	85	89	79	100
Scale drawing	85	89	79	94
Graphs	19	32	11	50
Reproduction	78	71	53	53
Graphic Solutions	22	36	37	31
Auxiliary Views	74	82	63	69
Revolutions	48	54	37	63
Developments	41	57	53	69
Schematics	33	46	37	69
No Drafting Skills	7	7	11	0

Table 6.05

Percentage of Graduates Using Design Skills One and Two Years After Training

Design Skills	Job-Oriented One Year (N=27)	Job-Oriented Two Years (N=28)	Field-Oriented One Year (N=19)	Field-Oriented Two Years (N=16)
Fixtures	52	46	26	69
Jigs	48	43	26	56
Molds	7	11	42	25
Dies	26	39	0	31
Machines	26	32	5	19
Tools	37	64	37	63
Layout	70	54	37	69
Products	26	29	21	25
Plant Layout	26	36	16	25
Gauges	26	43	37	50
Set-up Sheets	19	32	11	6
Templates	26	50	42	37
Die Casting	0	11	11	0
No Design Skills	22	10	47	19

of graduates were freehand lettering, sketching, dimensioning, sections, scale drawing, and orthographic projection. Two years after graduation all of the industrially employed field-oriented and 93 per cent of the job-oriented graduates were using some drafting skill.

Most noticeable changes in the percentage of graduates using design skills one year and two years after training were increases in the designing of tools for both groups and fixtures, jigs, dies, and layout for field-oriented graduates. The percentage of individuals using no design skills was reduced during that period of time for both groups.

Table 6.06

Percentage of Graduates Using Mathematics Skills One and Two Years After Training

	Training Program			
	Job-Oriented		Field-Oriented	
	One Year (N=27)	Two Years (N=28)	One Year (N=19)	Two Years (N=16)
Mathematics Skills				
Arithmetic	96	100	100	100
Algebra	74	93	89	94
Plane Geometry	93	89	74	81
Solid Geometry	37	43	16	44
Right Triangle Trigonometry	93	93	74	94
Oblique Triangle Trigonometry	70	71	63	56
Calculus	0	0	0	0
No Mathematics Skills	4	0	0	0

Among mathematics skills, arithmetic was used by all graduates, except one, a year after training. More specialized forms of mathematics - right triangle trigonometry, algebra, and plane geometry - were used by large percentages of graduates. None of the industrially employed graduates used calculus and less than one-half used solid geometry. It was interesting to note that at the end of year one, fewer job-oriented graduates reported using algebra than reported using right triangle trigonometry. A mathematician might argue that this was an impossibility, however, it seems probable that algebra was interpreted as algebra per se by those answering the inquiry about its use.

Job Satisfaction

The Job Description Index (Hulin & Smith, 1965; Smith, 1962) was used as a measure of job satisfaction. In Tables 6.07 and 6.08 the satisfaction of graduates with five aspects of their work is shown.

Examination of percentile scores indicated that scores on the "work" scale were higher than the other scales for the job-oriented graduates. This was true all three times the JDI was administered. Scores for this group on the "promotions" scale were stable. Fluctuations of 15 percentile points occurred on the "people" scale. Only on the "pay" scale were scores below the 50th percentile and these were consistently so.

For the field-oriented graduates there were fluctuations of 15 percentile points on the "supervision," "work," and "people" scales. There were lesser fluctuations in scores on the other two scales. No average score was below the 50th percentile for the field-oriented graduates. After two years on the job, scores on three of five scales were at the 50th percentile.

None of the fluctuations over time within the job-oriented and field-oriented training groups was significant. There were significant differences between the two groups on the "work" scale six months and one year after training.

Table 6.07

Job Satisfaction Scores for Job-Oriented Graduates Six Months and One and Two Years After Training

	Six Months[1]		One Year[1]		Two Years[1]	
	Raw	Percentile	Raw	Percentile	Raw	Percentile
Supervision	48.6	70	49.2	75	48.2	70
Promotion	20.4	65	17.2	60	17.4	60
Work	46.9*	90	44.1*	80	44.8	80
Pay	15.2	40	15.4	40	15.8	40
People	49.4	65	46.4	50	48.4	60

[1]Percentiles are based on scores of vocational high school graduates.
*t value difference between job-oriented and field-oriented means significant at .05 level.

Table 6.08

Job Satisfaction Scores for Field-Oriented Graduates Six Months and One and Two Years After Training

	Six Months[1]		One Year[1]		Two Years[1]	
	Raw	Percentile	Raw	Percentile	Raw	Percentile
Supervision	49.5	65	47.6	65	44.8	50
Promotion	20.2	65	20.1	65	18.6	60
Work	41.8*	70	37.6*	55	39.6	60
Pay	17.7	50	18.8	60	17.7	50
People	49.0	65	48.6	60	45.7	50

[1]Percentiles are based on scores for vocational high school graduates.
*t value for difference between job-oriented and field-oriented means significant at .05 level.

Mobility

Mobility as used here, was geographic and was defined in terms of moves between jobs and changes in residence. A graduate was considered to have made a move if he changed jobs and residences at the same time.

Of 28 job-oriented graduates employed in industry, 12 made a total of thirteen moves during the first year after graduation.

During the second year, three job-oriented graduates made one move each.

Thirteen of 20 field-oriented graduates in industry moved a total of 20 times during the first year after graduation. During the second year, one move was made by each of four field-oriented graduates.

Unemployment

During the first year following graduation there were 16 job-oriented and nine field-oriented graduates who experienced some unemployment. A total of 28 design graduates from the job-oriented program employed in industry had a mean 3.75 weeks of unemployment during the first year. Twenty field-oriented graduates employed in industry averaged 3.63 weeks of unemployment during the first year. One job-oriented graduate was unemployed for 26 weeks while the longest unemployment for a field-oriented graduate was 21 weeks.

Two job-oriented graduates were unemployed an average of two weeks each during the second year after graduation. During this same period, four field-oriented graduates were unemployed an average of 5.50 weeks each. The longest period of unemployment for any individual during the second year was nine weeks.

Employer Ratings

After graduates had been on the job for one year and again after two years on the job they were rated by their supervisors on four aspects of their job performance. Employer ratings are shown in Tables 6.09 and 6.10.

More than 50 percent (52 percent-77 percent) of the graduates of both programs were rated above average or outstanding during each rating on "manipulative work," "personal and social qualities," and "work qualities and habits." In "occupational technology," graduates of both programs tended to be rated average or above average. Smaller percentages (3 percent-12 percent) were rated below average or unsatisfactory.

With the exception of ratings for the field-oriented group on "manipulative work," there were larger percentages of graduates rated above average or outstanding after two years on the job than there were a year previous. These shifts were accompanied by decreasing percentages of average ratings.

Table 6.09

Employer Ratings of Job-Oriented Graduates
One and Two Years After Training

		Percentage of Graduates				
		Unsatisfactory	Below Average	Average	Above Average	Outstanding
Occupational Technology	1 yr.	0	8	56	35	2
	2 yrs.	1	4	52	40	4
Manipulative Work	1 yr.	0	10	37	48	4
	2 yrs.	0	12	28	52	8
Personal and Social Qualities	1 yr.	0	7	35	45	9
	2 yrs.	1	8	29	54	8
Work Qualities and Habits	1 yr.	3	5	22	47	23
	2 yrs.	0	10	19	53	18

Table 6.10

Employer Ratings of Field-Oriented Graduates
One and Two Years After Training

		Percentage of Graduates				
		Unsatisfactory	Below Average	Average	Above Average	Outstanding
Occupational Technology	1 yr.	0	10	53	36	1
	2 yrs.	0	12	42	41	5
Manipulative Work	1 yr.	0	7	36	46	11
	2 yrs.	0	12	37	41	10
Personal and Social Qualities	1 yr.	3	6	25	54	13
	2 yrs.	0	3	20	52	25
Work Qualities and Habits	1 yr.	0	10	27	42	21
	2 yrs.	0	6	20	55	19

Salary

Average weekly starting salaries for job-oriented graduates were $96.81 and $110.00 for field-oriented graduates. Average weekly salaries one year and two years after graduation are shown in Tables 6.11 and 6.12. In addition to the average salaries for all graduates, these tables show average salaries for graduates in selected geographic locations. These locations are metropolitan areas in which three or more graduates from one of the two training programs were employed. Twenty-six of 48 industrially employed graduates from the two programs were employed in these areas. Salaries for Class B Draftsmen are shown to serve as a base for comparison.

Table 6.11

Mean Weekly Salaries of Class B Draftsmen[1] and Industrially Employed Job-Oriented Graduates One and Two Years After Training by Geographic Location

Place of Employment	Class B Draftsmen	Job-Oriented Graduates One Year	Job-Oriented Graduates Two Years
Allentown-Bethlehem-Easton	$ 132.00[2]	$ 110.42	$ 125.43
Philadelphia	$ 136.00	$ 108.13	$ 131.50
Scranton	$ 106.50	$ 95.00	$ 110.30
All Graduates		$ 109.47	$ 120.02

[1]Draftsmen B was defined in the Occupational Wage Survey series published periodically by the Bureau of Labor Statistics, U.S. Department of Labor.
Performs nonroutine and complex drafting assignments that require the application of most of the standardized drawing techniques regularly used. Duties typically involve such work as: Prepares working drawings of subassemblies with irregular shapes, multiple functions, and precise positional relationships between components; prepares architectural drawings for construction of a building including detail drawings of foundations, wall sections, floor plans, and roof. Uses accepted formulas and manuals in making necessary computations to determine quantities of materials to be used, load capacities, strengths, stresses, etc. Receives initial instructions, requirements, and advice from superviaor. Completed work is checked for technical adequacy.

[2]Salaries were taken from Table A-2. "Professional and Technical Occupations - Men and Women," (Occupational Wage Survey, 1965b, 1965c, 1966a, 1966b, 1966c.)

Table 6.12

Mean Weekly Salaries of Class B Draftsmen and Industrially Employed Field-Oriented Graduates One and Two Years After Training by Geographic Location

Place of Employment	Class B Draftsmen	Field-Oriented Graduates One-Year	Field-Oriented Graduates Two Years
Philadelphia	\$ 136.00[1]	\$ 168.17	
Pittsburgh	\$ 145.00	\$ 94.50	
San Francisco-Oakland	\$ 137.00	\$ 155.33	\$ 172.75
All Graduates		\$ 125.25	\$ 133.20

[1]Salaries were taken from Table A-2. "Professional and Technical Occupations - Men and Women," (Occupational Wage Survey, 1965b, 1965c, 1966a, 1966b, 1966c.

Course Ratings

Graduates of each program were asked to indicate what value courses in their training programs had to them in the jobs they held. They rated each course as of no value, little value, undecided, some value, or much value in the job they held at the time of rating. These ratings were translated into numerical values (no value - 0, little value - 1, undecided - 2, some value - 3, much value - 4) and mean values for job-oriented and field-oriented graduates employed in industry are reported in Tables 6.13 and 6.14.

Perhaps the most noticeable feature in the two tables is that the rating of only one job-oriented course and three field-oriented courses declined between one year and two years after graduation. During the same period of time, mathematics in the job-oriented program moved from last place among courses to a tie for first place. Technical calculation and trigonometry were the two top rated courses in the field-oriented program by graduates of that program after two years employment.

Those courses rated relatively less valuable two years after graduation tended to be courses which were shorter in length. In the job-oriented program these included pneumatics (15 hours), hydraulics (15 hours), metallurgy (30 hours), quality control (30 hours), production problems (30 hours), and welding (16 hours).

Table 6.13

Value of Courses in Job-Oriented Training Program Rated by Graduates One and Two Years After Training

Courses:	One Year	Two Years	Change
Basic Engineering Drawing	3.60	3.90	+.30
Machine Shop	3.40	3.90	+.50
Mathematics	1.23	3.90	+2.67
Mechanics	3.00	3.57	+.57
Communications	2.90	3.50	+.60
Tool Design	3.14	3.47	+.33
Field Trips	2.83	3.37	+.54
Strength of Materials	3.40	3.33	-.07
Manufacturing Process	2.73	3.33	+.60
Welding	2.60	3.03	+.43
Production Problems	2.77	3.00	+.23
Quality Control	2.23	2.90	+.67
Metallurgy	2.70	2.70	0
Hydraulics	2.33	2.47	+.14
Pneumatics	1.53	1.97	+.44

Table 6.14

Value of Courses in Field-Oriented Training Program
Rated by Graduates One and Two Years After Training

Courses:	One Year	Two Years	Change
Technical Calculation	3.11	3.89	+.78
Trigonometry	3.22	3.78	+.56
Engineering Drafting	3.42	3.69	+.27
Tool & Die Design	2.84	3.67	+.83
Elementary Mechanics	3.11	3.61	+.50
Algebra	3.16	3.56	+.40
Product Design	2.78	3.56	+.78
Industrial Process	2.68	3.50	+.82
Problems in Machine Design	2.79	3.44	+.65
Jig & Fixture Design	2.68	3.33	+.65
Kinematics & Design of Machine Elements	2.74	3.18	+.44
Applied Mechanics and Strength of Materials	3.26	3.17	-.09
Fundamentals of Good Speaking	3.27	3.00	-.27
Mold & Die Design	2.05	2.94	+.89
Engineering Economics	2.26	2.94	+.68
Industrial Organization and Management	2.32	2.89	+.57
Slide Rule	2.63	2.88	+.25
Technical Writing	2.36	2.56	+.20
Elementary Physics	2.58	2.52	-.06

In the field-oriented program elementary physics (32 hours), technical writing (32 hours), slide rule (32 hours), and industrial organization and management (32 hours), were among the relatively shorter courses in the training program. Two other field-oriented courses which were 32 hours in length, trigonometry and algebra, were among the top rated courses.

Additional Education

During the two year period following graduation 12 job-oriented and 12 field-oriented graduates were involved in additional formal education. Two field-oriented graduates were full time college students while the other 22 were industrially employed and studying on a part time basis.

Seven job-oriented and two field-oriented graduates took part in company sponsored educational programs. These included formal courses conducted at the plant and educational conferences to which the employee was sent.

Two job-oriented and five field-oriented graduates employed in industry were attending college classes. Three job-oriented and three field-oriented graduates were taking correspondence courses.

Summary

Of the data presented in this chapter, the most pertinent evaluative data were considered to be those gathered during the third follow up two years after the completion of training. Those most recent data more nearly represent the level of accomplishment made available to graduates through training than do data gathered previously. Data gathered during training and the first and second follow up interviews provided baseline information and observation points on a continuum of change. Third follow up data did not represent a final static point of achievement, but indicated that the rate of change in employment characteristics of graduates had decreased. If additional interviews were to be conducted they would probably show a further decreasing rate of change in these characteristics.

Thirty-two of 35 students were graduated from the job-oriented program, although two graduates were not included in the follow up because their academic performance did not warrant their graduation as designers. Twenty-five of 40 students were graduated from the field-oriented program.

Thirty design graduates (28 in industry, two military) and two drafting graduates of the job-oriented were gainfully employed two years after training (91 percent). Two years after the completion of training, 21 field-oriented graduates (17 in industry, four military) were known to be gainfully employed. Three others had been gainfully employed and were known to be making geographic moves and might be credited as employed graduates of the field-oriented program. With this consideration, the field-oriented program graduated 24 individuals who were gainfully employed two years after training (60 percent).

None of the work fields in which graduates were employed two years after training was unrelated to the training received. The fields of drafting and engineering were most directly related with the other fields bearing varying degrees of lesser relationship. Fifteen field-oriented and 24 job-oriented graduates were employed in the work fields of drafting and engineering two years after training.

The majority of graduates employed in the work fields of drafting and engineering two years after training held jobs requiring them to compile data, have no significant relationship with people, and precision work things. The level of responsibility in dealing with data and/or people had increased for five (33 percent) field-oriented and ten (42 percent) job-oriented graduates in the year between the second and third follow up interviews. There was no significant difference in the number of graduates of the two programs in the levels with which they worked with data, people, and things two years after the completion of training.

Ninety-three percent of the job-oriented and all of the field-oriented graduates were using some drafting skill in their jobs.

Ninety percent of the job-oriented and 81 percent of the field-oriented graduates were using some design skills and all graduates of both programs employed in industry were using some mathematics skills two years after the completion of training.

The satisfaction of graduates with their employment tended to change during their first two years after training. Satisfaction scores of job-oriented graduates tended to fluctuate although none of these fluctuations were significant. Job satisfaction scores for field-oriented graduates tended to decrease over time, but not significantly so.

There was a decrease in the number of moves made by graduates of both programs during the second year after training as compared to the first year. Thirty-three geographic moves were made during the first year and seven during the second year.

Average weekly salaries for both groups of graduates appeared to be increasing at a decreasing rate. Increases during the first year were larger than increases during the second year. The salaries of field-oriented graduates were larger than those of job-oriented graduates. In two out of three metropolitan areas, where three or more job-oriented graduates were employed, salaries of Class B Draftsmen were higher.

During the second year after the completion of training two job-oriented graduates were unemployed an average of two weeks and four field-oriented graduates were unemployed an average of 5.50 weeks.

With the exception of the rating for manipulative work for field-oriented graduates, there was a higher percentage of above average and outstanding ratings by employers two years than one year after training. Some of this change in ratings was probably due to changes in on-the-job performance of graduates but some of the variability was probably due to inconsistencies in ratings. The perceptions of raters may have changed without actual changes in the worker's performance and there were some different employers involved in each of the two ratings.

Graduates of each program reported the utility of training courses in the jobs they held. In both programs, courses in drafting, mechanics, and mathematics were rated as of much value. The machine shop and communications courses in the job-oriented program were also considered to have much value. In the field-oriented program, other courses of much value were tool and die design, product design, and industrial processes. As perceived by graduates of the two programs, the value of all but five courses in the two programs increased during the second year on the job.

Twelve job-oriented and 12 field-oriented graduates continued in some type of formal educational program during the first two years after training. Nine were attending college (two full-time), nine were involved in company sponsored in-plant courses and educational conferences, and six were taking correspondence courses.

The level of social class identification of graduates did not increase during the first two years after training as it had during the training programs. There had been significant increases in the level of social class identification during training. After two years on the job, the social class identification of graduates was not significantly different from what it had been before training.

CHAPTER VII
CONCLUSIONS AND RECOMMENDATIONS

In summarizing the conclusions of this study and making recommendations for it's implementation, a single decision was not reached about whether job-oriented or field-oriented training was better. As in the evaluation of many complex processes, products, and mechanisms, the use to be made affects the utility of what was evaluated. Additionally, merits of one alternative are often offset by merits of the other alternative. Therefore, the several variables which were evaluated in this study, will be presented individually here. Decision makers, in the context of their objectives, must view the findings of this study against the background of the social conditions at the time the decision is to be made.

Conclusions

Student training achievement. Was there any difference in the training achievement of students in the job-oriented and field-oriented programs? Was there a difference in training achievement related to personal characteristics of the students?

As measured by four standardized tests, there were no significant differences between groups in the gains they made during training. Significant gains were made by job-oriented students on two tests of mathematics and one test of mechanical comprehension. Field-oriented students made a significant gain on one test of mathematics and one test of spatial relations.

There were significant differences between job-oriented and field-oriented groups in scores on eight of 12 sections of the Design Skills Test. Of these, the subject matter of five sections was common to both programs.

The standard of achievement indicated by the dropout-retention rate in the two training programs was not the same. Thirty of 35

students who entered the job-oriented program graduated as designers. Two more, who had failed mathematics were graduated as draftsmen. Of 40 who entered the field-oriented program, 25 were graduated. Twelve of the 15 dropouts were dropped because they had failed a course prerequisite to continuation of the program. Ten dropouts had failed mathematics or mathematics based courses.

In common terminology, all of the students admitted to the two training programs would have been considered above average in ability, but there was some spread in levels of ability. Within this range of abilities, the lower ability students achieved more in the job-oriented program than they did in the field-oriented program. Those students with lesser ability were dropped out of the field-oriented program. Test scores for the job-oriented group on the Purdue Industrial Mathematics test indicated a gain in means and a decrease in variance. Over the period of training, the low scores for the group were improved. There wasn't any evidence to indicate whether students of higher ability level achieved more in one program or the other. It should be remembered at this point, that it is generally more difficult to show gains in improvement with more capable individuals.

The second question asked about student achievement was whether there were any differences related to the personal characteristics of the students. Of several biographical and psychological variables used, approximately 50 percent of the variance in predicting grade point average could be explained with four variables. Grade point average in the job-oriented program was best explained by two measures of spatial ability, a mathematics test, and age. In the field-oriented program a measure of mathematics ability, a measure of mechanical comprehension, years since last mathematics course was completed and age were the best predictors. The only common variable was age, which was the smallest contributor in prediction of the factors mentioned. There were personal characteristics related to training achievement, but importantly, these were different for the two programs.

Vocational interests. Was there any difference in the effect the two training programs had on vocational interests?

Prior to training there were some differences between groups as measured by the Minnesota Vocational Interest Inventory. Students in the job-oriented program scored significantly higher than field-oriented students on five occupational scales indicating interests more like individuals in mechanical occupations. The job-oriented group also scored higher on the "outdoors" scale.

The training programs did not differentially effect interests of the two training groups. Both groups did show a significant change in interests during training. They both scored significantly higher on the "milk wagon driver" scale after training. Their interests had become significantly more like those of milk wagon drivers. Cogitation on this point only suggests a common interest among milk wagon drivers and draftsmen-designers in orderliness. It was important to note though, that a training program would effect the interests of adult men.

Social class identification. Did the training programs differentially effect the social class identification of the students?

Social class identification was measured by having individuals in the training programs rate 42 occupations as socially higher, lower, or the same as his own occupation. During the period of training there was a significant difference in the change of the scores of the two training groups. The scores of both groups went up and the scores of the field-oriented group went up significantly more than those of the job-oriented group. After two years on the job, the scores of both groups had decreased and were not significantly different from what they were before training.

It appeared that the training programs had the effect of raising social position of the students in their self-perceptions. However, after two years of facing the realities of their work they had lowered their personal social estimate. Perhaps their work had not materialized as they had idealized it at the conclusion of training.

Attitudes toward training. Did students in the two programs have differing attitudes toward the training they received? To answer this question, students were asked: (1) if they would choose the training program over again, (2) if the training program was what they had expected before they enrolled, and (3) if they would like to remain in the occupational field for which they were being trained in the future.

Students from both programs, with the exception of two field-oriented students, responded positively that they would choose the training program again. There was no significant difference in the responses of job-oriented and field-oriented students to this question.

Both times the question of whether the training program met students pretraining expectations, there was a significant difference in the responses of the two groups. In both cases, job-oriented students found the training more to their expectations. With the benefit of hindsight, it appeared that the preselection orientation better described the job-oriented program than it did the field-oriented program and the expectations of students in both programs may have been similar, but the training different.

There were significant differences in the responses to the question about remaining in the occupational field of training. Significantly more job-oriented than field-oriented students indicated their desire to remain in machine and tool designing or a closely related field. However, the majority of respondents from both programs wanted to work toward a more technical field. Some field-oriented but no job-oriented students wanted less technical or unrelated work.

For various reasons, one of which was suggested here, job-oriented students appeared to be more satisfied with their training and showed more desire to remain in the occupational field than did field-oriented students.

Job responsibilities. Was there a difference in the job responsibilities of graduates of the job-oriented and field-oriented training programs?

In comparing the job responsibilities of graduates of the two training programs, data were gathered about the graduates work field involvement with data, people, and things, work skills used, and work aids used.

During the first two years after the completion of training, 30 design graduates (28 in industry, two in military service) and two drafting graduates of the job-oriented program were gainfully employed (91 percent.) During the same period, 25 field-oriented graduates (21 in industry, 4 in military service) were gainfully employed (63 percent).

Two years after graduation, 24 job-oriented and 15 field-oriented graduates were employed in the work fields of drafting and engineering. The other graduates of both programs for whom data were available, with the exception of those in the military service, were in work fields which were related to the training programs. It was possible to prepare unemployed and underemployed persons as technicians within a 12 month training program.

There were no significant differences between groups of graduates employed in drafting and engineering in the level of their involvement with data, people, or things. There were some shifts upward and some fewer shifts downward within both groups during the first two years of employment.

Among all industrially employed graduates of the two training programs, 97 percent of the job-oriented and 100 percent of the field-oriented used some drafting skill two years after training. More importantly, percentages of graduates using more complex drafting skills such as orthographic projection, sections, dimensioning, and scale drawing were high. Changes within groups during the first two years of employment were relatively small.

Two years after the completion of training, design skills were being used by 90 percent of the job-oriented and 81 percent of the field-oriented graduates in industry. These percentages represented some increase over reports of the first and second interviews.

All graduates were using some mathematics skills two years after training. The majority were using specialized skills such as right triangle trigonometry (93 percent job-oriented, 94 percent field-oriented), plane geometry (89 percent job-oriented, 81 percent field-oriented), and oblique triangle trigonometry (71 percent job-oriented, 56 percent field-oriented). None of the industrially employed graduates was using calculus, which had not been taught in either program. Work aids used by graduates did not indicate any differences between programs, but tended to conform with the work skills used. Drafting equipment, technical handbooks and tables, vendor's catalogs and company specification manuals, and desk calculators and slide rules were most frequently used.

Evaluating on the basis of the several measures of job responsibility used here, there was not sufficient evidence to say that there were any differences between graduates of the two programs, the job-oriented program showed almost 50 percent better production than did the field-oriented program. This was due to the number of persons dropped out of the field-oriented program which was more selective in graduating persons judged to meet higher standards. However, job responsibilities for those persons do not appear to be any higher than they were for the graduates of the less selective job-oriented program. It might be reasoned that field-oriented program graduates had not been on the job for a sufficient period of time to realize the advantages of their training. But, the pattern of changes during the first two years would have to be altered appreciably for the field-oriented graduates to gain an advantage in job responsibilities over the job-oriented graduates.

Job Satisfaction. Was there any difference in satisfaction with their jobs between job-oriented and field-oriented graduates?

Satisfaction with five aspects of the graduate's job were measured. Scores for the job-oriented group were consistently higher than those for the field-oriented group on the "supervision" and "work" scales. Field-oriented graduates scored consistently higher on the "pay" scale than did job-oriented graduates. Scores on the "work" scale were significantly higher for job-oriented graduates than for field-oriented graduates six months and one year after training.

Mobility. Was there any difference in the geographic mobility of graduates of the two programs? Was mobility related to age or marital status of the graduates?

Most of the movement of graduates took place during the first year after training. Thirty-three moves were made by graduates during the first year and seven moves were made during the second year. There was a significant difference in the number of job-oriented and field-oriented graduates who moved to take their first job after training. Field-oriented graduates made more moves.

There was a significant difference in the age of graduates who moved to take their first job and those who didn't. The mobile graduates were younger than the immobile graduates.

Married graduates did not move any more or less than single graduates to secure their first jobs.

Unemployment. Was there any difference in the rate of unemployment of graduates of the two programs? Was unemployment related to the mobility of the graduates?

There were no significant differences in the unemployment of graduates of the job-oriented and field-oriented programs. The average length of time to secure the first job after graduation was approximately four weeks for both groups. About half of the graduates of both programs experienced some unemployment during the first year after training. Two job-oriented and four field-

oriented graduates were unemployed for periods during the second year after training.

An analysis of the unemployment and mobility data revealed that there was a significant relationship. In particular, graduates who moved to secure their first job required .81 weeks to begin work while those who did not move required 5.53 weeks to secure their first job.

Employer ratings. Was there any difference between programs in the ratings given graduates by their employers?

Employers rated program graduates one and two years after the completion of the training programs. There were no significant differences between the ratings given the two groups. The majority of both groups were rated above average or outstanding on "manipulative work," "personal and social qualities," and "work habits." They were rated average or above average on "occupational technology." Ratings tended to be higher two years after training than they were one year after training for both groups.

Salaries. Was there any difference in the salary earned by graduates of the two programs? Were salaries related to the mobility of graduates?

Field-oriented graduates were earning higher average weekly salaries at the time of each of the three interviews. Beginning salaries were $96.81--job-oriented, $110.00--field-oriented. After one year the job-oriented graduates in industry were averaging $109.47 weekly, field-oriented graduates were averaging $125.25 weekly. Two years after training averages were: job-oriented--$120.02, field-oriented --$133.20 Although it could not be adequately tested in this project, it appeared that salaries were influenced more by the location of work than they were by level of responsibility of the worker.

Average beginning salaries of all graduates who moved to secure their first job were higher than for those graduates who did not move to their first job. However, there was a significant interaction between mobility and training program. Mobile field-oriented graduates had higher average beginning salaries than mobile job-oriented graduates. On the other hand, the average beginning salaries of immobile job-oriented graduates were higher than for immobile field-oriented graduates.

Average salaries for the groups in this study could be noticeably influenced by the outstanding high or low salary of an individual because of the size of the groups. The determinants of salaries for the training groups were elusive. However, for presently unexplainable reasons, field-oriented graduates earned consistently higher average weekly salaries than did job-oriented graduates. The effects of factors such as work locations, mobility, previous work experience, and the reputations of the parent educational organizations were not fully ascertained.

Course ratings. Was there any difference in the value of training as rated by employed graduates of the training programs?

A precise comparison of ratings of courses was not possible because graduates of the two training programs rated different courses. A comparison by subject areas was possible. Most of the courses in both programs were rated as of "some value" or "much value" by graduates two years after training. Two job-oriented courses were rated "undecided" by graduates of that program. Graduates of both programs rated drafting, design, and mathematics courses highest.

Additional training. Was there any difference in the enrollment in additional training after graduation between job-oriented and field-oriented graduates?

Twelve job-oriented and 12 field-oriented graduates were engaged in some type of formal education during the first two years of training. There may have been a greater tendency for field-oriented graduates to attend colleges while more job-oriented

graduates were taking correspondence courses and courses conducted at their work location, but not part of their jobs. The number of people involved made it impossible to draw any conclusion.

Recommendations

Selection of students. Specific criteria for the selection of students for programs of technical education cannot be recommended on the basis of this research. With two programs having generally the same occupational objective, as was the case in this project, the predictors of success in training were peculiar to the individual programs. Institutions offering programs of technical education should develop selection criteria for their own programs. This would have the distinct advantage of allowing the admission of students who might be excluded by more general selection standards and give greater assurance of the success of those admitted. The success of some students in this project who did not meet all of the criteria for selection serves as evidence.

The relationship of interests and factors related to age and training success suggest the need for additional study in these areas. This research only hinted at the possible influence of these factors.

This project demonstrated that students could be found among the ranks of underemployed and unemployed who could be prepared for gainful employment as technicians. With a concern for the full employment of all individuals it would be desirable to repeat this and other similar efforts to prepare technicians.

Length of training. This project offered evidence that persons employable as technicians could be prepared in periods of time other than those typically used. In cases where there is a demand for workers, the shortening of the period of preparation should be considered. This is particularily desirable when students are

to be taken from the labor force for training. This training may not prepare them for employment for the rest of their lives, but it does give them the opportunity for employment in occupations in which they may grow and prepare for change.

Utilization of faculty. Particularily with retraining programs, it seems possible to use part-time faculty efficiently. These persons, especially when employed in industry related to the training, can make significant contributions. Their efforts need the coordination of an individual who has overall responsibility for the training. Having at least one full-time faculty member is also desirable, since he can give some continuity to the program for the students.

Course content. As a book cannot be judged by its cover, a training program should not be judged by its course titles. In the job-oriented and field-oriented training programs there was considerable similarity in course titles, but less similarity in what was taught. More important distinctions can probably be made on the basis of specific training objectives. Such objectives not only evidence themselves in the course of study, but they permeate instructional procedures as well. When a concept is taught with the objective of application on the job, it will probably be given an applied illustration in the classroom. There would appear to be an advantage to job-oriented education, in this respect, since it is probably more difficult to give precise definition to the objectives of field-oriented education.

Flexibility in training. A training program must be viewed as a means to a goal rather than a goal itself. Within a highly structured educational program, subgoals, in the form of required courses, become important to the completion of training. These course requirements should periodically be re-evaluated to determine if they are consistent with the occupational goal for which the program purports to prepare students. Students, individuals as they are, may not conform to the total structure of required courses and prerequisite courses, but have attributes in sufficient

quantities to make them well accepted members of an industrial team. Requirements that are held of all students should be evaluated against the realities of the requirements for performance of the job.

Flexibility can also be practiced in scheduling and the selection of teaching materials. This project demonstrated the opportunity for both.

Credit for training. The majority of students in both training programs reported their desire to advance to more technical jobs or jobs with more responsibilities. This suggests that they may need additional education if they are to achieve that goal. As these training programs were structured, there was no provision made for the transferability to another educational institution of the course work they had completed. In many cases, this may mean that students desiring to continue their education will have to repeat part of their training program to be admitted to the more advanced educational programs they seek. Future programs should attempt to provide for granting credits transferable to other educational programs.

Relationship of education to work. Another recommendation for making educational programs more relevant grows out of the observation of instructional aids used by students in the classroom and work aids used by those same individuals on the job. If the student can acquaint himself with the types of equipment he will be expected to use on the job while he is in training, adjustment to that job should be easier. A rather simple survey of workers in the occupations for which training is offered would reveal the work aids they use in performing their work.

Job placement. The transition from work to employment was troublesome in this project. That it took an average of almost four weeks after training for graduates to begin work is evidence of this. Some individuals who waited for long periods to begin work because they would work only in a single locality greatly influenced this average. However, there were other cases of seemingly unnecessary delays. To relieve the problem it appears

to be important to start early and to seek out prospective employers. Many industries took two or three weeks to approve the employment of a technician. This was even longer when a security clearance was needed. Channels of communication between employers of technicians and educators of technicians do not seem to exist to the extent that some other channels do. An active program of seeking possible places of employment and describing the potentialities of those to be placed needs to be followed to develop these necessary channels of communication.

Follow up procedures. Evaluative data about the employment of program graduates provide measures of the output of an educational program not available elsewhere. The job of gathering this information is difficult, if done thoroughly. Job titles held by graduates of the job-oriented and field-oriented training programs would not have provided accurate indicators of their job responsibilities. If information useful for program evaluation is to be collected, it is imperative that a detailed analysis of what workers do be undertaken. The job analysis procedure developed by the United States Bureau of Employment Security provides a system for this type of data collection. Although much useful information may have been secured as this procedure was used in this project, more detailed information is needed. Greater definition should be given to the drafting, design, and mathematics skills used by workers. Finer discriminations could be made within the levels of involvement of workers with data, people, and things.

Since job analysis, as a follow up procedure, is expensive in time and effort, it is suggested that program administrators could randomly sample graduates and analyze the jobs of a smaller representative group. If this were carefully done, it would add a dimension of comprehensiveness to knowledge about the job responsibilities of graduates. Limited analyses could also be undertaken to provide feedback for specific course evaluation. For example, a detailed analysis of the mathematical functions used by graduates could be undertaken.

Employer ratings. Employer ratings, as a form of evaluative information, are interesting but of questionable usefulness. It is very difficult to discern if shifts in ratings reflect changes in the performance of the worker or in the perception of the rater. There is an additional question about the standard being applied by the rater. If one rater can rate several employees this problem is alleviated. When several raters are involved the comparability of ratings is difficult to attain.

Intangible qualities of work. There are some seemingly intangible qualities associated with work which provide challenges for additional research. Among these are job satisfaction, social class identification, and mobility. This study did not provide adequate answers about why workers move, what makes them satisfied with their work or what their work means to them in a social context. Answers to these and many other similar questions would provide clues about the ways in which desired outcomes could be achieved through educational programs.

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APPENDIX A

DESCRIPTION OF FILMS

Upgrade: 16 mm. black and white, sound motion picture, 17 minutes in length.

This film is intended to describe the job of a tool design technician and the training required to enter this occupation.

Through an interview with a research engineer the job of the tool design technician in drafting, designing, problem solving and planning and his role as a member of a design team and communicator between the engineer and the craftsman are described.

An interview with a student presently in training is used to describe the training curriculum in tool design technology and demands made upon the student. Specific reference is made to the conditions of training under the Manpower Development and Training Act and the provisions for the student under this act.

The Retreads: 16 mm. black and white, sound motion picture, 28 minutes in length.

The purpose of this film is to describe two training programs for the preparation of mechanical technicians. One program was job-oriented to prepare tool design technicians and the other was field-oriented to prepare machine and tool design mechanical technicians. The objectives of a research project of these two training programs are described.

Through interviews and a narration the problems of supplying modern industry with technicians are discussed. Students describe their backgrounds and attitudes toward retraining. Training administrators and faculty discuss their philosophies of retraining and describe some of the ways in which these philosophies were put into practice. The film focuses on some of the sociological aspects of retraining. Specific questions to be answered by the research are raised and tentative answers to some of these are given. A more complete research report accompanies the film to answer many more of the research questions.

APPENDIX B

1. Interviewer________ INTERVIEW FORM Interview Number_____
2. Interview Date_____ Allentown (1), Altoona (2)___

VOCATIONAL EDUCATION DEPARTMENT
THE PENNSYLVANIA STATE UNIVERSITY

3. Employee's Name ______________________ Code Number_____________

4. Home Address ____

5. Establishment Job Title ______________ Supervisor Confirmation__

6. Supervisor's Name ____________________ Job Title______________

7. Establishment Name _______________________________________

8. Total number of jobs with different employers, April 1, 1967 to March 31, 1968 . . . . .______________

9. Number of times changed residence, April 1, 1967 to March 31, 1968 . . . . .______________

10. Number of weeks unemployed, April 1, 1967 to March 31, 1968 . . . . .______________

11. Base number of hours worked per week as of April 1, 1968 . . . . .______________

12. Base salary before deductions as of April 1, 1968 (no overtime but include cost of living):____________

13. Have you taken or are you taking any courses? (Period April, 1967-April, 1968) No (0), Yes (1), No Data (9) . . . . .______________

Course Title (s) ____

For what purpose did you take this course? . . . . . .____________

(1) To earn a certificate or diploma (Specify ___________________)
(2) To aid in development of job skills only
(if yes, state how course was sponsored ___________________)
(3) to pursue an associate degree (college credit)
(4) To pursue a 4 year college degree.

DIRECTIONS: We would like to know how you feel about the value of the training program courses as related to your present job. We want you to answer each item as honestly as you can. Please circle the response which corresponds the closest to your feeling about each course.

No Value :	Little Value :	Undecided :	Some Value :	Much Value :		
NV	LV	U	SV	MV	1.	Pneumatics
NV	LV	U	SV	MV	2.	Welding
NV	LV	U	SV	MV	3.	Metallurgy
NV	LV	U	SV	MV	4.	Tool Design
NV	LV	U	SV	MV	5.	Mechanics
NV	LV	U	SV	MV	6.	Field Trips
NV	LV	U	SV	MV	7.	Strength of Materials
NV	LV	U	SV	MV	8.	Production Problems
NV	LV	U	SV	MV	9.	Mathematics
NV	LV	U	SV	MV	10.	Machine Shop
NV	LV	U	SV	MV	11.	Manufacturing Processes
NV	LV	U	SV	MV	12.	Quality Control
NV	LV	U	SV	MV	13.	Hydraulics
NV	LV	U	SV	MV	14.	Communications
NV	LV	U	SV	MV	15.	Basic Engineering Drawing

DIRECTIONS: We would like to know how you feel about the value of the training program courses as related to your present job. We want you to answer each item as honestly as you can. Please circle the response which corresponds the closest to your feeling about each course.

No Value :	Little Value :	Undecided :	Some Value :	Much Value :	
NV	LV	U	SV	MV	1. Elementary Physics
NV	LV	U	SV	MV	2. Applied Mechanics and Strength of Materials
NV	LV	U	SV	MV	3. Algebra
NV	LV	U	SV	MV	4. Fundamentals of Good Speaking
NV	LV	U	SV	MV	5. Trigonometry
NV	LV	U	SV	MV	6. Jig and Fixture Design
NV	LV	U	SV	MV	7. Elementary Mechanics
NV	LV	U	SV	MV	8. Produce Design
NV	LV	U	SV	MV	9. Industrial Organization Management
NV	LV	U	SV	MV	10. Mold and Die Design
NV	LV	U	SV	MV	11. The Slide Rule and Its Use
NV	LV	U	SV	MV	12. Technical Calculation
NV	LV	U	SV	MV	13. Kinematics and Design of Machine Elements
NV	LV	U	SV	MV	14. Industrial Processes
NV	LV	U	SV	MV	15. Engineering Drafting
NV	LV	U	SV	MV	16. Technical Writing
NV	LV	U	SV	MV	17. Problems in Machine Design
NV	LV	U	SV	MV	18. Engineering Economics
NV	LV	U	SV	MV	19. Tool and Die Design

15. What math do you use in your job? (0) No, (1) yes, (9) No Data

____Arithmetic?
____Algebra?
____Plane Geometry?
____Solid Geometry?
____Calculus?
____Right Triangle Trigonometry?
____Oblique Triangle Trigonometry?

16. What drafting skills do you use in your job? (0) No, (1) Yes, (9) No Data

____freehand lettering
____sketching
____pictorial drawings
____orthographic drawings
____sections
____dimensioning
____scale drawing
____graphs
____reproduction
____graphic solutions (descriptive geometry)
____auxiliary views
____revolutions
____developments
____schematics

17. What designing do you do? (0) No, (1) Yes, (9) No Data

____fixtures
____jigs
____molds
____dies
____machines
____tools
____layouts
____die casting
____products
____plant layout
____gages
____set up sheets (programming)
____templates

18. Machines, tools, equipment and work aids used. (0) No, (1) Yes, (9) No Data

____Drafting Machine
____Parallel Bar
____Drafting equipment (ie compass)
____Slide rule
____Desk calculator
____Company spec. manuals
____Vendors catalogs
____Technical handbooks
____Tables (ie slope, rise, trig)
____Micrometers
____Calipers
____Machinist gages (ie plug, ring)
____Dial indicators
____Lathe
____Drill press
____Grinder
____Milling machine
____Shaper
____Planer
____Comparator
____Special shop equipment machinery
____Other (Specify)________

19. Work Location (s): Shop____%; Office____%; Outside____%

20. a. What does the worker do? (With percentages of time). ______

______

______

______

______

b. How does he do it? ______

______

______

______

______

c. Why does he do it? ______

______

______

______

______

d. What skill is involved? ______

______

______

______

______

ADMINISTER JOB DESCRIPTION INDEX
ADMINISTER EMPLOYER RATING SCALE

Job Analysis Form	Analyst______
Vocational Education Department
The Pennsylvania State University	Date______

1. Employee Name______ 2. Establishment Job Title______

3. Establishment Name______ Address______

4. Description of Duties: (continue on separate sheet if necessary)

5. Sentence Analysis:

Verb (worker function)	Immediate Objective	Infinitive (work field)	Obj. of Inf. (MPSMS)

6. Analysis Classifications:

Hierarcy	Worker Function	Wt.	Work Field	Code	MPSMS	Code
Data						
People						
Things						

OE 6000 (REV. 9-66)

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
OFFICE OF EDUCATION

ERIC REPORT RESUME

(TOP)

ERIC ACCESSION NO.

CLEARINGHOUSE ACCESSION NUMBER

RESUME DATE: 08 26 68

P.A.

T.A.

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TITLE

EFFECTS OF FIELD AND JOB ORIENTED TECHNICAL RETRAINING ON MANPOWER UTILIZATION OF THE UNEMPLOYED.

FINAL REPORT

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The Pennsylvania State University, University Park, Pa. Department of Vocational Ed.

SOURCE CODE

REPORT/SERIES NO.

OTHER SOURCE

SOURCE CODE

OTHER REPORT NO.

OTHER SOURCE

SOURCE CODE

OTHER REPORT NO.

PUB'L. DATE 30 September 1968 CONTRACT/GRANT NUMBER OE-4-10-108

PAGINATION, ETC.

117 p. OE PROJECT No. 5-0085

RETRIEVAL TERMS

IDENTIFIERS

ABSTRACT

This project compared job-oriented and field-oriented programs for the preparation of mechanical technicians on the basis of several training and employment variables. Students were selected from unemployed and underemployed persons identified by the Pennsylvania State Employment Service and trained under the provisions of the MDTA. From the job-oriented program, 30 of 35 students were graduated as designers and 25 of 40 students were graduated from the field-oriented program. Interviews were conducted with graduates six months, one year and two years after training. There were no significant differences in groups in their level of involvement with data, people, or things. Over 80 percent of the graduates of both programs were using specialized drafting, designing and mathematical skills on the job. There were no significant differences in job satisfaction of the two training groups. Average weekly salaries were higher for field-oriented graduates, although immobile job-oriented graduates earned more than immobile field-oriented graduates. Mobile graduates experienced a significantly shorter period of time to secure their first job. Graduates rated courses in drafting, mechanics, and mathematics as of much value. It was recommended that shorter training periods be considered for the preparation of technicians in critical occupations and that training program flexibility be encouraged.